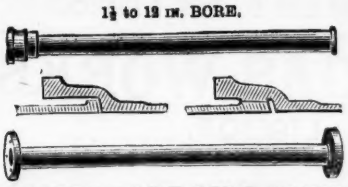
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXII. No. 1574.] LONDON, JULY 11, 1893. [45TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1¼ to 12 IN. BORE.



THOMAS ALLAN & SONS,

Bon Lea Foundry,

SOUTH STOCKTON-ON-TEES.

ALSO MANUFACTURERS OF

SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

GLASGOW OFFICE: 24, GEORGE SQUARE.

Telegrams:

"BONLEA, STOCKTON-ON-TEES."

"SPRINGBANK, GLASGOW."

— ESTABLISHED 1830. —

PARKER & LESTER,

Manufacturers & Contractors.

THE ONLY MAKERS OF

PATENT ANTIMONY PAINT,

Parker's Imperial Black Varnish,

Oxide Paints, Oils, and General Stores for Gas and Water Works.

WORKS:

ORMSIDE STREET, OLD KENT ROAD, LONDON.

WOLSTON'S

TORBAY PAINTS

Special Quotations to Gas Companies.

DARTMOUTH, DEVON.

Lanemark Coal Co.,

LIMITED.

LANEMARK CANNEL

AND GAS COALS.

Quotations and Analysis on application to

LANEMARK COLLIERY,

NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

THE "C" BURNER.

NEW HIGH-POWER GAS-LIGHT.

INCANDESCENT GAS-LIGHT SYSTEM.

Consumes

4 cubic feet per hour.

Gives a light of

70 to 80 candle power.

Brilliant Light.

Perfectly Steady and

Noiseless.

Smokeless.

Reduced Heat.

Can be attached to any Gas-Fittings.

THE TRIUMPH OF GAS OVER ELECTRIC LIGHT.

Taking Gas at 3s. per 1000 cubic feet and Electric Light at 8d. per Board of Trade unit, the "C" Burner will produce an equal amount of light at **One-eighth the cost of Electric Light.** This cannot be disproved.

Prices and particulars on application to

THE INCANDESCENT GAS-LIGHT COMPANY, Ltd.,

14, PALMER STREET, WESTMINSTER, LONDON.

Near St. James's Park Station.

SAWER AND PURVES,

LATE

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER,

Manufacturers of

IMPROVED CONSUMERS' WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

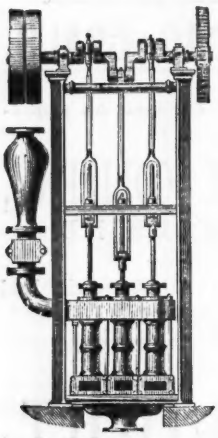
AND

IMPROVED DRY GAS-METERS.

SPECIALITY: PATENT CASH PREPAYMENT METERS.

STEAM & HAND PUMPS FOR GAS-WORKS,

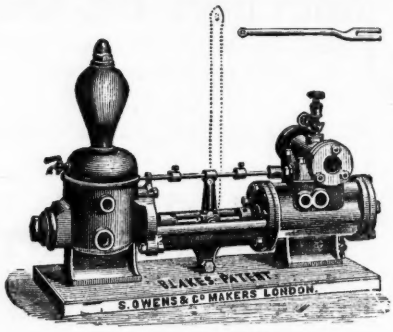
FOR PUMPING TAR, WATER, AND LIQUOR.



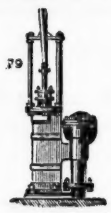
Treble-Barrel Pumps in Frame.

Syphon Pump.

Double-Barrel Force-Pump in Frame.



BLAKE'S
PATENT
STEAM PUMPS.
20,000 IN USE.



Improved Double Action Pump.

Cast-Iron Hand-Pump.

Wrought-Iron Portable Pump.

S. OWENS & CO., Hydraulic, Gas, & General Engineers, WHITEFRIARS ST., LONDON, E.C.

SOLE MANUFACTURERS OF

MANN & OWENS' PATENT SCREW & CAM, also FULL-WAY RACK & PINION GAS-VALVES.

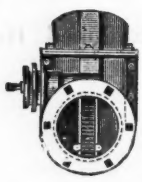
S. O. and Co.'s New Catalogue of Gas Apparatus and General Machinery can be had on application.

NEWTON, CHAMBERS, & CO., LIMITED

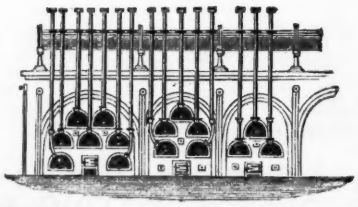
THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

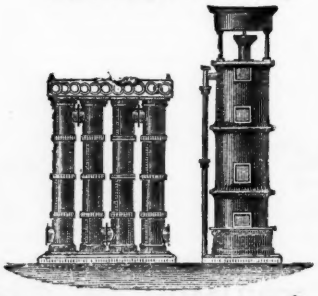
SLIDE VALVES,
WITH RACK & PINION
OR
Internal or External
SCREWS, of all Sizes.
GASHOLDERS,
AND
Gasholder Tanks.



CAST-IRON RETORTS,
RETORT-BED FITTINGS,
And Retort-House Appliances
of every description,
Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.

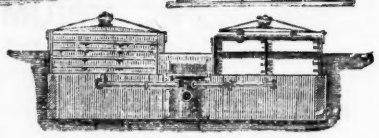


WROUGHT AND CAST IRON
CONDENSERS,
SCRUBBERS, & WASHERS,
TAR AND LIQUOR PUMPS, &c.



PATENT
CENTRE VALVES
for working Purifiers.
Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,
HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS,
WOOD GRIDS.
CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

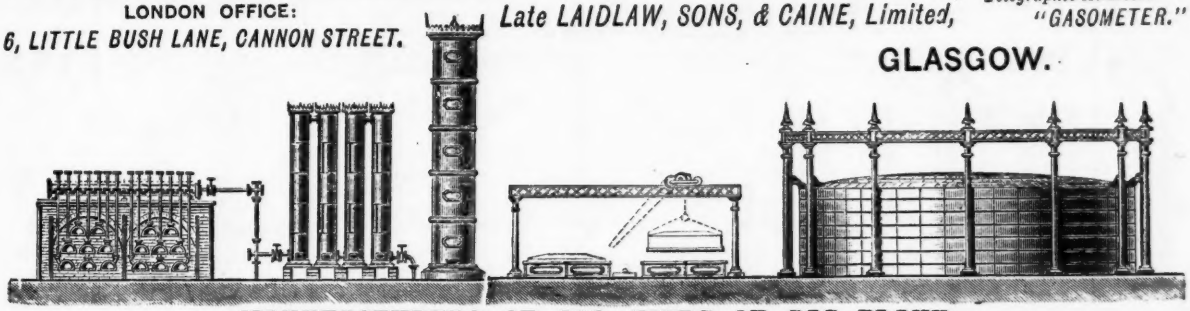
GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

THE BARROWFIELD IRON-WORKS, LIMITED,

LONDON OFFICE:
6, LITTLE BUSH LANE, CANNON STREET.

Late LAIDLAW, SONS, & CAINE, Limited,
GLASGOW.

Telegraphic Address:
"GASOMETER."



MANUFACTURERS OF ALL KINDS OF GAS PLANT.

RETORT-BENCH FITTINGS; SIEMENS'S REGENERATIVE AND ORDINARY FURNACES;
CONDENSERS, EXHAUSTERS, AND ENGINES; SCRUBBERS, WASHERS;
PURIFIERS, WITH PLANED AND CEMENT JOINTS;
DRY AND HYDRAULIC CENTRE-VALVES;
HYDRAULIC AND HAND-POWER LIFTING APPARATUS;
GASHOLDERS, SINGLE-LIFT & TELESCOPE; CAST & WROUGHT IRON TANKS;
STATION METERS; GOVERNORS; SCREW AND RACK VALVES;
FOUR-WAY COCKS AND HYDRAULIC VALVES;
CAST-IRON GAS, WATER, & STEAM PIPES & CONNECTIONS; WROUGHT-IRON TUBES & FITTINGS;
IRON ROOFING, MARKET BUILDINGS, BRIDGES, GIRDERS, STEAM BOILERS;
PROMENADE PIERS AND LOADING WHARVES.

MANUFACTURERS OF OIL PLANT OF EVERY DESCRIPTION.

HENDERSON'S Patent Retorts, Condensers, Stills, Cast and Wrought Iron Tanks, Ammonia Stills, Wrought-Iron Gas-Mains, &c., &c.

DESCRIPTIVE SPECIFICATIONS AND ESTIMATES ON APPLICATION.

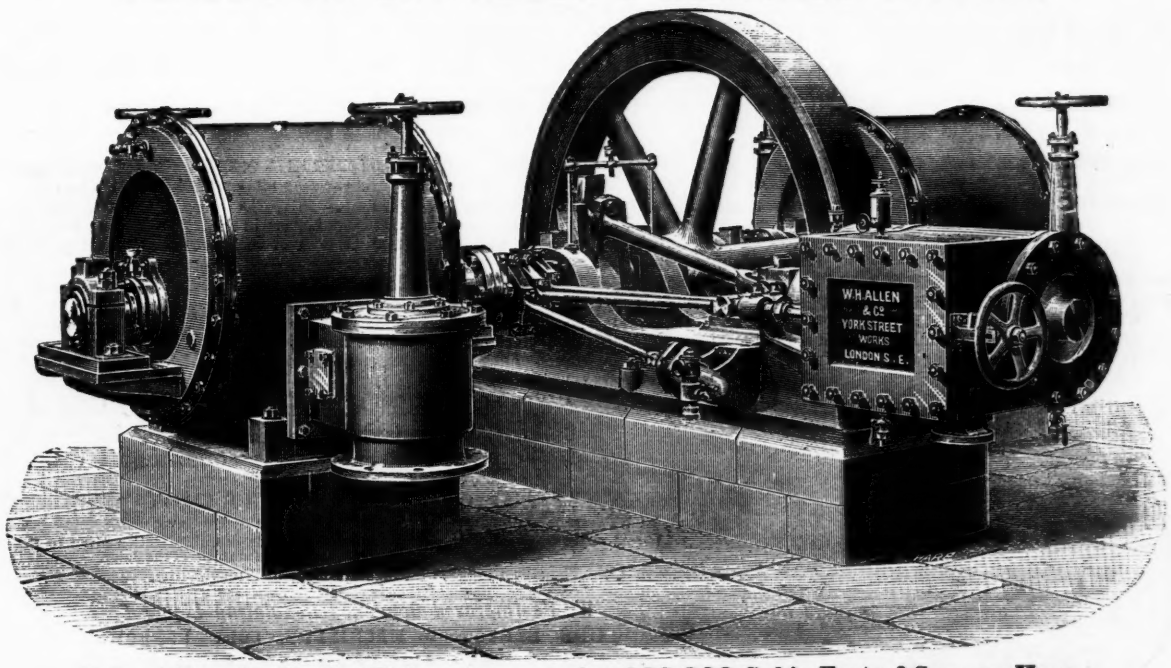
W. H. ALLEN & CO.,

York Street Works, LAMBETH, LONDON, S.E.,

MAKERS OF THE MOST IMPROVED FORM OF

GAS EXHAUSTING MACHINERY.

BEALE'S PATENT—ALLEN'S COMBINED SYSTEM.

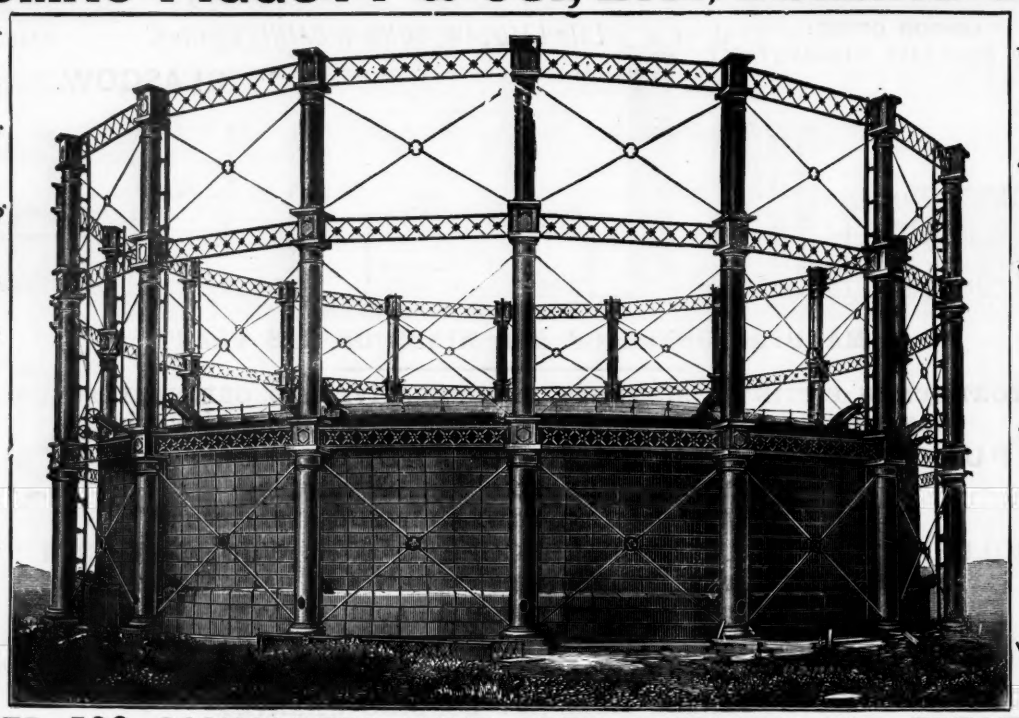


Pair of Non-Oscillating Exhausters, passing 200,000 Cubic Feet of Gas per Hour.

THOMAS PIGGOTT & CO., LTD., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS RETORT FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS, BIRMINGHAM.

WELDED & RIVETED PIPES, FOUL MAINS, RETORT LIDS, & CAST TANKS, PURIFIERS.

OVER 500 GASHOLDERS HAVE BEEN SUPPLIED AND ERECTED,

INCLUDING THOSE SUPPLIED TO THE FOLLOWING GAS COMPANIES AND CORPORATIONS:

BATH.	BOLTON.	BRISTOL.	CHELTENHAM.	LEAMINGTON.	PRESTON.	SHEFFIELD.
BELFAST.	BOMBAY.	BRISBANE.	HARTLEPOOL.	LIVERPOOL.	READING.	STOCKHOLM.
BECKTON.	BRADFORD.	CARDIFF.	LEEDS.	NOTTINGHAM.	RIO GRANDE.	SYDNEY.
BIRMINGHAM.	BRIGHTON.	COVENTRY.	LEICESTER.	OLDHAM.	SOUTH METRON.	VIENNA.

WEST'S GAS IMPROVEMENT Co., Ltd.,

Engineers, Ironfounders, & Contractors,

ALBION IRON-WORKS, MILES PLATTING, MANCHESTER,

MANUFACTURERS OF

WEST'S PATENTED MACHINERY

FOR

CHARGING AND DRAWING GAS-RETORTS.

OVER **240** MACHINES AT WORK AND IN COURSE OF CONSTRUCTION.

Advantages attending its use are:—

INCREASED VOLUME of GAS per TON, and INCREASED YIELD per Retort.—The system of breaking and distributing the coals in an even layer in the retorts effecting more perfect carbonization.

REDUCTION in LABOUR and COST of WORKING.—In Works where this System of charging and drawing Retorts is adopted, there has been effected a substantial saving in the cost of Gas Manufacture in the Retort-House; the amount saved varying in different Gas-Works from **8 PENCE** to **15 PENCE per Ton** of coal carbonized. Full particulars will be forwarded upon application to W. G. I. Company, Limited.

MANUAL CHARGING AND DRAWING MACHINES.

POWER CHARGING AND DRAWING MACHINES, driven by COMPRESSED AIR, STEAM, or ROPE. The power machines are applicable to circular, oval, or ∩-shaped retorts and mouthpieces, and are the most perfect, economical, efficient, and durable machines made. They are constructed on principles founded by long and extensive experience in this special branch of gas engineering and the manufacture of gas.

MAKERS OF COAL BREAKING, ELEVATING, AND CONVEYING MACHINERY, COKE BREAKING AND WASHING MACHINERY.

Sole Makers of **CIRCULAR, OVAL, or ∩-shaped MOUTHPIECES** with Morton's Self-Sealing Lids, fitted with

KING'S PATENT FASTENINGS,

secure a very tight joint; and at the same time the eccentric motion given to the Lid effectually removes the Tar from the surfaces of the Joint.

N.B.—The whole of these Fittings are made of Wrought Iron. Several Thousands in use.

West's Improved Combined Regulating Liquor Seal Valve.

OXIDE ELEVATING MACHINERY, COKE BARROWS, VALVES, AND ALL GAS-WORKS PLANT, &c.

Illustrated Catalogue sent upon application.

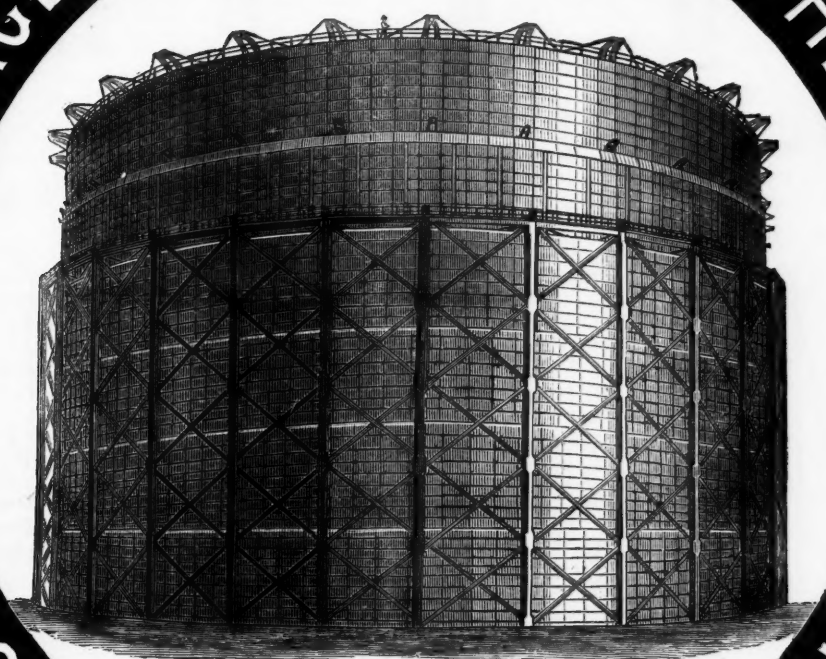
Mr. JOHN WEST, M.Inst.C.E., *Managing Director.*

Wrought-Iron TUBES And Fittings and Accessories.

LAMBERT BROS., WALSALL,
MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM
BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., Short Street, LAMBETH.

JOHN BROWN & CO., LTD., SHEFFIELD,
Proprietors of
ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
ALDWARKE MAIN GAS COAL
Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
Telegrams: "ATLAS SHEFFIELD."

CLAYTON SON & Co LTD
MAKERS OF
WORKS LEEDS
THE LARGEST GASHOLDER IN THE WORLD
CAPACITY 12 MILLION CUBIC FT.
GASHOLDERS OUR SPECIALITY



ERECTED AT EAST GREENWICH FOR THE
South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR.

MAKERS OF GAS PLANT OF EVERY DESCRIPTION
ROOFS PURIFIERS &c. ALSO
ADDRESS LONDON 60, QUEEN VICTORIA ST.
TELEGRAPHIC "GAS, LEEDS."
GASHOLDERS OF ANY SIZE
ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

Gas Lamps and Posts.

Several thousands of these are now in use, giving general satisfaction. They are strongly made, and of best material.

Patent Street Lamps.

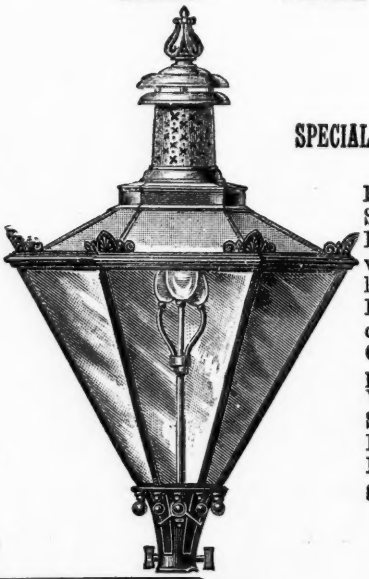
NO PUTTY.

Lamplighters' Torches.

Lever Taps.

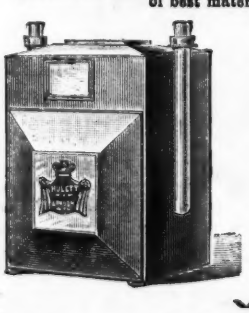
Lamp Governors.

PRICE LIST ON APPLICATION.

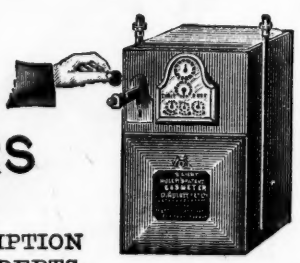


SPECIAL HIGH-POWER LAMPS.

For Lighting Streets, Refuges, Promenades, &c., where a good light is required. Fitted with Porcelain cone, Copper top and perforation, Wrought-Iron Spray, Lever Tap, Burner and Patent Governor, glazed with Opal top.



GAS-METERS.



PREPAYMENT METERS

(PRICE'S PATENT)

SPECIALLY ADAPTED FOR INCREASING CONSUMPTION AMONG SMALL CONSUMERS. NO RISK OF BAD DEBTS.

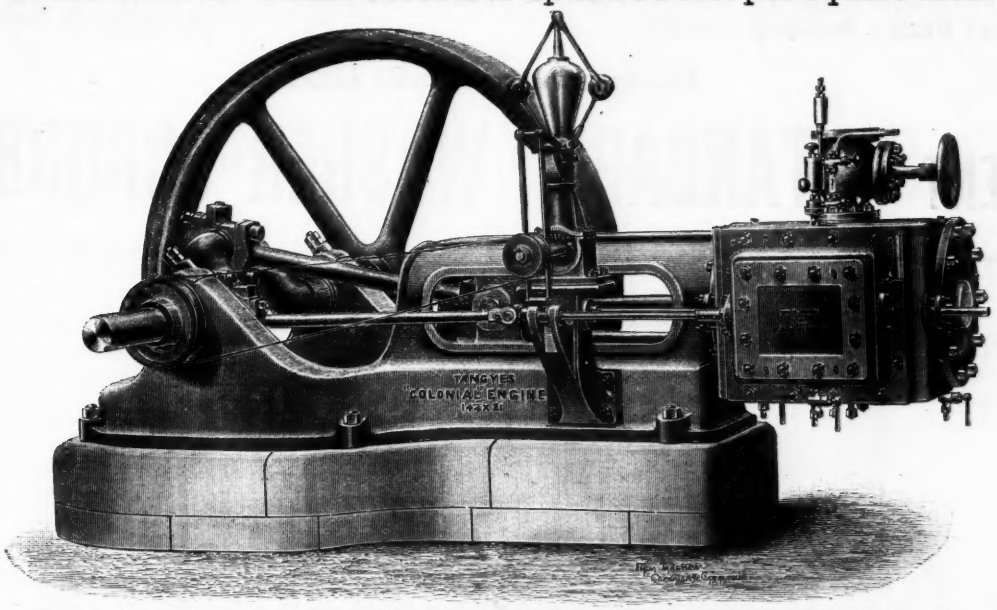
D. HULETT & Co., Ltd.,

55 & 56, HIGH HOLBORN, LONDON.

TANGYES'

"COLONIAL" STEAM-ENGINE

Constructed for Steam Pressures up to 100 lbs. per square inch.



Tangyes' "Colonial" Steam-Engine, with the TANGYE-JOHNSON PATENT AUTOMATIC CUT-OFF GEAR. From a Photograph of the 14½ in. by 21 in. size.

PRICES QUOTED ON RECEIPT OF THE NECESSARY DATA.

TANGYES LIMITED, Cornwall Works, BIRMINGHAM.

AND LONDON, NEWCASTLE, MANCHESTER, GLASGOW, SYDNEY, MELBOURNE, JOHANNESBURG, GENOA, BILBAO, AND ROTTERDAM.

Telegrams: "TANGYES BIRMINGHAM." *Copyright. Entered at Stationers' Hall. No. 69 E.*

GASHOLDERS

A Four-Lift Gasholder, nearly 200 feet high and 8 million cubic feet capacity, has been recently erected by us for The Gaslight and Coke Company, London.

PURIFYING MACHINES.

PURIFIERS. SULPHATE PLANT.

Weck's Centre-Valve.

C. & W. WALKER,

MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE;

10, Finsbury Square, London.

"FORTRESS DONNINGTON." "FORTRESS LONDON."—Telegraphic.

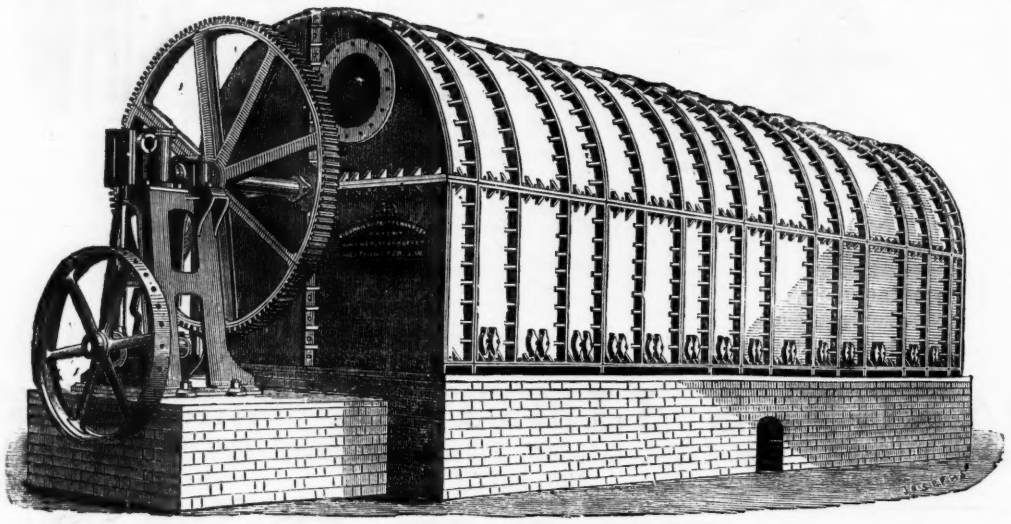
KIRKHAM, HULETT, & CHANDLER,

LIMITED.

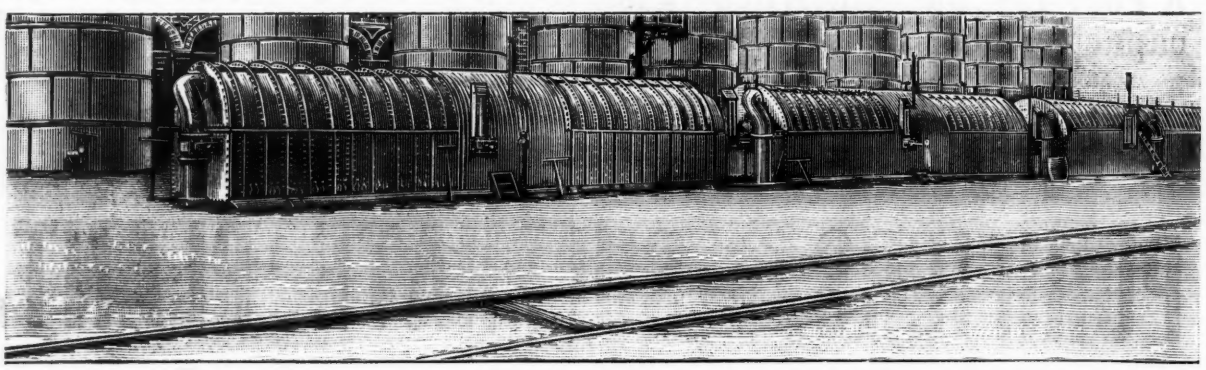
(SIDNEY HERSEY, Managing Director.) (J. CHANDLER, Engineer.)

Patentees of the

PATENT "STANDARD" WASHER-SCRUBBER.



☛ **465 of these Machines (capable of dealing with 440,807,000 cubic feet of Gas daily) have been supplied, which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.**



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company; the Engines driving same being under Galvanized Iron Covers. Six additional Machines are now in use at these Works.

ADDRESS:—

3 & 4, PALACE CHAMBERS, BRIDGE STREET, WESTMINSTER. S.W.

ESTABLISHED 1827.

W. & B. COWAN,

ESTABLISHED 1827.

SQUARE

STATION METERS

OF

Elegant Design

AND

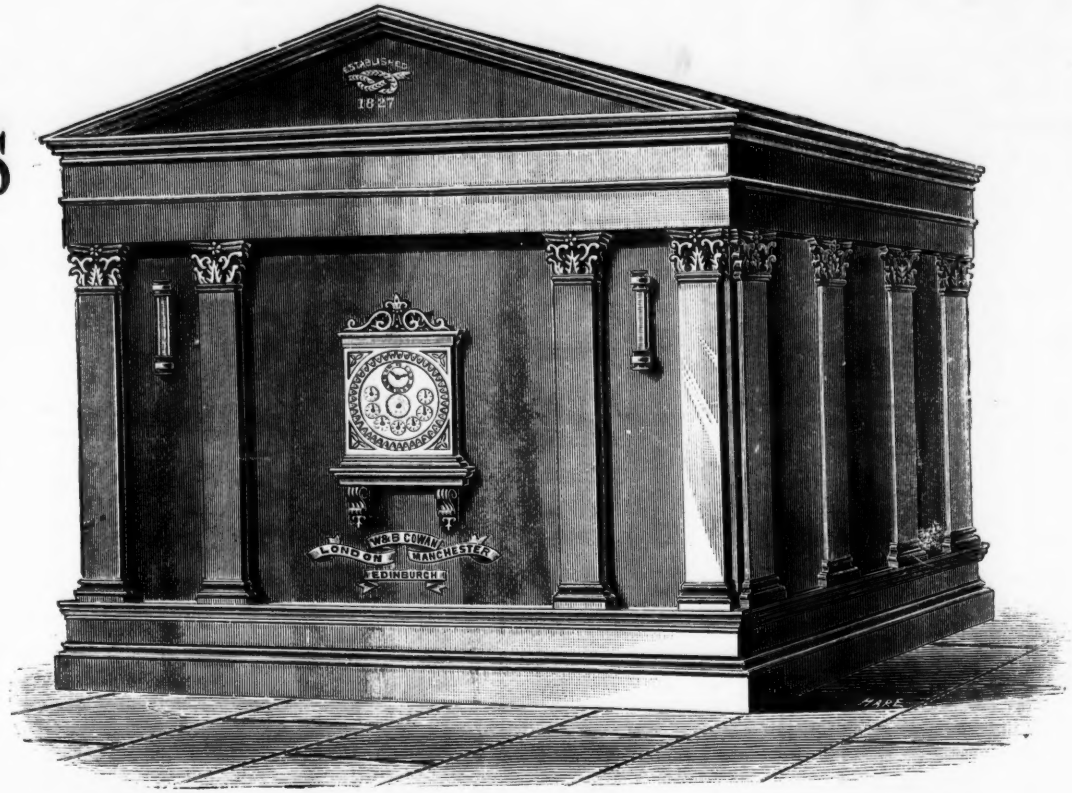
Improved Construction,

WITH

Planed Joints

AND ALL

Modern Improvements.



ROUND

STATION METERS

IN

All Sizes,

UP TO AND INCLUDING

30,000 Cubic Feet per Hour.

Prices and all Particulars on application.

SQUARE STATION METER—B Design. Other Designs furnished on application.

SMITH SQUARE WORKS, WESTMINSTER,
LONDON, S.W.
TELEPHONE No. 3250.
"DISC LONDON."

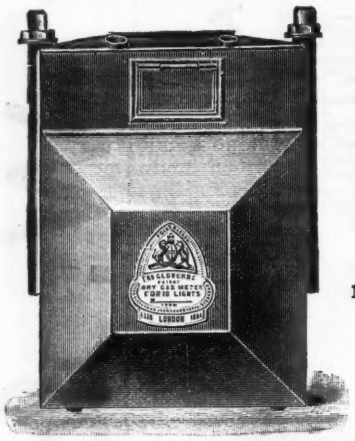
DUTTON STREET WORKS,
MANCHESTER.
TELEPHONE No. 1545.
TELEGRAPHIC ADDRESSES:
"DISC MANCHESTER."

BUCCLEUCH STREET WORKS,
EDINBURGH.
TELEPHONE No. 753.
"DISC EDINBURGH."

[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;
The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.



1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.
Are upheld for five years without charge.

Telegraphic Address: "GOTHIC LONDON."
Telephone No. 6725.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

BRISTOL: 62, VICTORIA STREET. *Telegraphic Address: "GOTHIC."*

BIRMINGHAM: 3, BRIDGE ROW, DERITEND. *Telegraphic Address: "GOTHIC."*

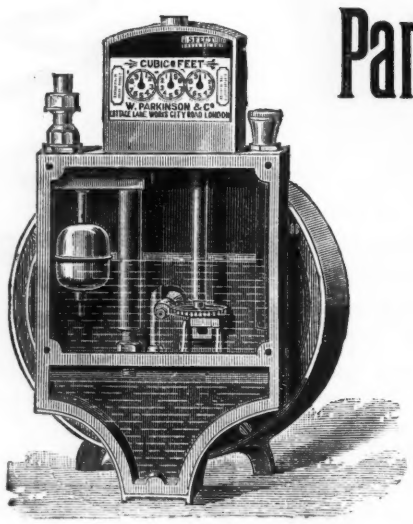
LEEDS: BOAR LANE CHAMBERS, 4, BASINGHALL STREET. *Telegraphic Address: "GOTHIC."*

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address: "GOTHIC."*

W. PARKINSON & CO.

ESTABLISHED 1816.

MANUFACTURERS OF WET METERS.



Parkinson's Cast-Iron Case Meter.

Works with very little friction.

Will stand very high pressures.

Cannot possibly be shut off by sudden increase of pressure; the float being affected by outlet gas only.

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[See also Advt., p. 108.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 11, 1893.

The Gas Affairs of Leeds.

THE decision of the Leeds City Council to reduce the standard illuminating power of the gas supplied by the municipal undertaking from 19½ candles, at which it was fixed in 1888, to 18½ candles, in accordance with a resolution adopted by the Gas Committee on the 30th of May, is deserving of notice as an indication of the prevailing tendency of gas-works administrators. Alderman Gilston, in moving the adoption of the resolution, relied solely upon grounds of economy. Not since 1885 have the Committee succeeded in making both ends meet; and they now labour under an accumulated deficit of £30,000, which is costing £1200 a year for interest. It is considered, rightly enough, that steps should be taken for getting rid of this indebtedness, and squaring the revenue account. As Alderman Gilston put it, there are three ways whereby this desired end might be attained: The price of gas might be raised, the illuminating power might be lowered, or the works might be better managed. It is satisfactory to learn, after what has already happened in Leeds, that the Alderman only mentioned the first course in order to dismiss it as objectionable. When treating of the second course, he displayed a very creditable degree of mastery of the principle involved. It is undoubtedly true that 18-candle gas will answer as well as 19-candle gas for cooking, and also for gas-engines and gas-fires; but the same might be said for 16 or 15 candle gas while one is about it. The true point of Alderman Gilston's case lies in the discrepancy between the cost of the candle of difference between 18½ and 19½ candle gas, and its value to the consumer. His remarks upon this head are not conclusive, unless it can be assumed that the critical point of quality for the common coal carbonized at Leeds is 18½ candles. The "critical point" is a term which we venture to use here to mean the highest average quality of gas that can be got out of a coal in the ordinary way of working, with elimination of the carbonic acid as in sulphur purification, but without resorting to carburetting. It varies for different districts, according to the class of coal that suits the locality best. It may be as high as Alderman Gilston puts it for Leeds; but, if so, the coal is remarkably good at the price. High or low, however, it is a limit beyond which any increase of illuminating power is apt to cost an exaggerated sum, altogether out of proportion to its value to the consumer. Alderman Gilston rather overdid his part here; for he talked about the extra candle costing "from 3d. to 4¼d. per 1000 cubic "feet." Surely, this is handicapping the alteration with too great promise of economy. However, this matter must stand where the Council have left it. Alderman Gilston said one or two funny things by way of discussing the third of his roads to economy—a possible improvement of the management of the gas-works, or rather, as we should prefer to put it, of the undertaking. For it is quite possible, though the Leeds City Council are not in a mood to see it, for one or half-a-dozen gas-works to be well managed, as isolated factories, while the undertaking to which they belong has to get along as best it can with no real management at all, to speak of. Upon this moot subject, Alderman Gilston braced himself up to declare that the Leeds management is all that can be desired—a statement which is, of course, supported by the little deficit that has been rolling up since 1885, notwithstanding a considerable increase of price.

It is difficult to discuss this delicate matter without appearing to indulge in reflections upon individuals; and this we have no intention of doing. It is necessary, however, to enter a most emphatic protest against Alderman Gilston's conclusion in favour of what he calls "managing" gas-works, upon the cheap mutual-rivalry system. It is only by a travesty of the truth that the Alderman was able to claim that Leeds is acting upon lines that "all "successful corporations are beginning to follow." We do not mean the question as a reflection upon the Managers of the Leeds Gas-Works, who are able and conscientious station superintendents; but, in an emergency, would anybody send to Leeds for gas engineering advice? If the Leeds Gas Committee were in Parliament to-morrow, would they be able to take a lead without outside help? Alderman Gilston knows better; and he must also be aware that Leeds would have to go far and pay "through "the nose" for assistance in gas engineering matters in time of need. Gas engineering, as a profession distinct from, and above mere station management, for which an intelligent foreman is good enough, needs educated, high-minded gentlemen; but if every town acted like Leeds there would be none such to be had. This is a general consideration which is not likely to weigh heavily with the present City Council. They will want something more specific to prove the weakness of their system of administering the gas undertaking by what Mr. Tweedale described as a "Committee of Amateurs" over and above the three Station Superintendents. Here it is: For some reason unknown to us, no statistics relating to the Leeds undertaking were supplied to the compiler of Field's "Analysis" for the year 1892; and it is therefore impossible to institute a comparative survey of the working for last year. In the "Analysis" for 1891, however, we find this: Although the make of

gas per ton of coal was pretty good, as it ought to be with 22·53 per cent. of cannel, the proportion sold was absolutely the lowest of any undertaking in the returns; the unaccounted-for gas being 11·57 per cent. of the whole make, while the amount of gas used on the works and offices (and mostly waste) was only exceeded by Manchester. The return from residuals was also the lowest for all the Corporations, with the single exception of Manchester, where the coke is of little value. The bad debts were far and away the heaviest on the list—not a serious matter, perhaps, but of a piece with the rest of the performance; and it was the only undertaking which achieved a deficit. If they think this is a record to be proud of, the Leeds Gas Committee must be the most self-complacent body of "amateurs" of gas administration in the three kingdoms. The Committee affect to regard with horror the idea of "one man rule" for the gas undertaking; but if any man who *was* a man, and knew his business, could not save his salary ten times over in putting the concern into a respectable way of management, he would deserve—well, to be elected upon the Committee.

The Impending Crisis in the Coal Trade.

It was only to have been expected that the demand of the coalowners in the district covered by the Miners' Federation for a reduction of wages by the heavy proportion of 25 per cent. would arouse the strongest opposition on the part of the men affected and their representatives on the Federation Executive. It is reported that preparations are in progress for taking a ballot of the men on the proposals of the coalowners; and there is little doubt as to what the result will be. The vote of the Midland men is to be obtained upon the questions: "Are you in favour "of a 25 per cent. reduction of wages?" and "Are you "in favour of arbitration?" Putting the questions in such a form can only bring out replies in one sense. Of course the men will object to the 25 per cent. reduction, and to arbitration also, if the latter suggestion is placed before them as a means of bringing about the former. The condition of the coal trade is serious; but it is rather to be hoped than expected that a readjustment of the cost of coal-getting to suit the market will be made without a struggle. The Union leaders are probably pleased in their hearts that this attack upon wages should be offered just now, since it may be supposed to cause the men to rally round their trade organizations, which have suffered so sadly from recent disasters. It is to be noticed that the professional leaders of the Dockers' and Seamen and Firemen's Unions have hastened to offer their co-operation to the miners, in the event of the latter determining to strike. This is the old game, which did not work in the case of Hull; and if the miners have any hope of resisting the coalowners' proposals on their merits, the less they ever have to do with the New Unionist gang the better. There is some force in the argument that the present crisis in the coal trade is in a measure due to the absence of any strong and united organization of the whole of the miners of the country with which the employers might have reckoned, and which could, perhaps, have resisted the partial reductions of wages, in certain districts, that have tended to make the coal trade unprofitable everywhere. But to constitute and keep intact a national union of miners is a very large order. It is doubtful if such a trade society could be formed at any time; and nothing of the kind can be done now in time to deal with the impending crisis. The issue in the coming struggle, if it comes to a strike or a lock-out, will rest as usual upon the question of ways and means. The men are not supposed to be well provided with funds; and it is hopeless to look for outside help for tens of thousands of idle hands. If the owners really mean what they say, they will win in the long run, at the cost, it may be, of widespread dislocation of trade, and of immeasurable suffering for those upon whom the stress of deprivation will fall. Arbitration would be by far the best way out of the difficulty; but it is only too likely that the coalowners have prejudiced the men against this remedy by first naming the amount of reduction they want. If they had put the matter in this way: "The "price of coal does not warrant the existing rates of "wages, but we are quite willing to submit to arbitration "the question of what rates should be paid," it is at least possible to say that the way to arbitration would have been rendered smoother. It is true that when people in business dispute about a payment, and agree to refer the matter to arbitration, the amounts that one side asks and the other offers are generally in evidence; and arbitration proceeds with full cognizance of both. But a commercial arbitration is different from an arbitration on the subject of wages; and some consideration is due to the human nature that enters into the question in the latter case. Members of the Mining Federation would not be human, still less trade unionists, if they accepted, without the strongest protest they are capable of making, the double-barrelled proposal of their employers. We say this without denying the possibility of the employers being right in their interpretation of the necessities of the time. It is not to be imagined, however, that the coalowners themselves expect the men to accept a sweeping reduction of one-quarter of the whole amount of their wages without kicking against it. The time for negotiation has not yet expired, and it is to be hoped that, before definite action is taken on either side, means may be found for bringing the opposing interests face to face, in order that the nature of the issue shall not be obscured either between the parties or in the eyes of the public. Let there be no talk about smashing Unions, or reflections upon anybody's dignity; but if the coal trade of the country is to be convulsed by a fight over the mere question of rate of wages, let there be no mistake about it, either of nature or degree.

Gas for the Royal Wedding Illuminations.

Mention is made in another place of the fact that the illuminations in London and other towns in honour of the Royal Wedding testified to the continued popularity of gas for this purpose. Lest it should be imagined that there is any great advantage, in the sense of immediate commercial profit, in supplying gas for these gala occasions, it may be as well to state that the output of The Gaslight and Coke Company for last Thursday was actually less by about 3 million cubic feet than on an ordinary day. This fact is accounted for by the suspension of business, and the general exodus of the people into the streets. The consumption of gas, which is so prominently in evidence on illumination nights, does not nearly equal what goes on when the community is about its ordinary business, and the people are living their usual indoor life. This truth, which will probably surprise the public, goes to show how closely the use of gas is identified with the common lot of town populations. Nobody can see from without the household gas-burners serving their appointed duty in domestic and business interiors from nightfall to shutting-up time. But there they are, in countless number; and when the people turn out into the streets, although it may be to see gas burnt in lavish profusion with the object of turning night into day, the gas-holders indicate the suspension of the customary demand. We are glad that this is so; for, while one likes to see gas everywhere, out of doors as well as in, and helping sight-seers to rejoice and make merry as well as to work and watch—still, anybody may take the street lighting, and illuminations to boot, so long as gas remains the principal agent for lighting the warehouse, shop, and home.

The Coal-Tar Colour Industry.

A remarkable lecture on the "Development of the Coal-"Tar Industry" was lately delivered to the Chemical Society of Berlin by Herr H. Caro. Although it is possible that we may have to say something more about this address, it is both too long, and the general tone of it is too little in accord with our usual range of subjects to warrant our reproducing it. The author begins his remarks, however, in a style calculated to arrest the attention of any gas manager. "Look!" he cries. "Upon "one hand lies tar—an encumbering bye-product; on the "other hand are its derivatives, the legion of aromatic "compounds, with their applications growing every day "more numerous in the sciences, the arts, and industries; "indispensable for the researches of the man of science, "of the chemist, the physiologist, the bacteriologist, the "physician; bases of colours innumerable; bases of "precious synthetical medicaments, of the perfumes of "flowers and musk, of sweetmeats a hundred times more "luscious than honey, of explosives of unheard-of power! "How has it all been done—what yet remains possible to "this coal-tar chemistry?" To these questions the only possible answer is a review of the whole course of the coal-tar industry, which Herr Caro proceeds to supply. In this task he takes, as a German, national pride.

Created in England and in France, this vast industry, despite unfavourable geographical conditions, the distance of the markets for the raw material, notwithstanding customs barriers and foreign restrictions upon patents, has made its greatest progresses in Germany, and has been naturalized there. This has been due, according to the lecturer, simply to the fact that, in the German coal-tar industry, science and industry, theory and practice, have gone hand in hand. "The "factories put at the disposal of the seekers their products "and their bye-products, and make no mystery of the "observations and experiences of their daily routine. In "return, they acquire new raw materials, fresh working "methods; they learn the constitution of their products, "the mechanism of their formation." If it can hardly be said that in a German colour-works there are as many chemists as factory hands, the proportion of laboratory workers to unskilled labourers is very much greater than is customary elsewhere. An English critic, remarking upon this system, says that it is the German fashion, and as such seems to answer well in the hands of the people who developed it. It by no means follows, however, that the same method of working would yield the same results elsewhere. Every people must follow the bent of the national genius; and the truth seems to lie in the broad statement that synthetic chemistry accords with the German temperament, wherefore Germans have done well at it. At the same time, it must be remembered that the British trade in coal-tar derivatives is far from being a contemptible one.

The Value of the Rupee.

The recent order of the Governor-General of India in Council, fixing for the time being the value of the rupee at 1s. 4d. sterling, has had astonishing results in all parts of the world—more particularly, of course, in those regions where silver has been a standard of value. We do not pretend to an understanding of the question of currency, and so we shall not follow the example of the newspapers in affecting the authoritative style in discussing a matter of which the average journalist is certainly as ignorant as anybody else. We are, however, interested in the fortunes of many Gas Companies doing business in silver countries; and we shall await with some concern the comment on the currency question which any alteration of the circumstances of these undertakings must supply. The peculiarity of the situation is that, although the action of the Indian Government is described as having had a ruinous effect upon the United States and other countries, where silver has been held as bullion, nobody ventures to say that this action is either wrong or mistaken. Bimetallists do not seem to know what to say about it; but since the most of what they do say is unintelligible, this matters little. What we should dearly like to see, in connection with these questions of currency, is a statement of what lawyers call "an A "and B case;" showing in the concrete the effects of different methods of solution upon typical industries. Foreign and colonial gas companies should have instructive experience in this kind, if one could only get at it. The policy of foreign gas undertakings must be profoundly modified by considerations of exchange, when these are susceptible to such violent oscillations as have been scored against certain countries of late. The only fixed idea which we admit in relation to these subjects is that there can be but one standard of value, just as there is only one standard of length, of weight, or of any other quality of matter. It is immaterial what may be the nature or the name of the standard, which one man may call by one designation and another by something quite different. The dimensions of a standard in favour in one locality may differ from those in vogue in another; but, so long as only a clerical or an arithmetical adjustment is needed to express one standard in terms of the other, commerce does not suffer from the nominal difference. The British foot we know, and the metre of the Latin races we know; and we can buy or sell in terms of either, or both. So with coal, which we export, or carbonize by the ton into cubic feet of gas, and can equally send out to where the gas is measured in cubic metres and the coal is calculated in kilogrammes. But how could one manage with two feet as standards of length—one shorter than the other, but by how much nobody might tell with certainty from day to day? So it is with silver and gold. One or the other must be the standard of value, if the world is to keep sane, to say nothing of solvent.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTIETH ANNUAL GENERAL MEETING,

HELD AT

THE CITY HALL, BELFAST, JUNE 13TH, 14TH, & 15TH, 1893.

DENNY LANE, ESQ., M.A., President.

DISCUSSIONS ON THE PAPERS.

(*Concluded from p.* 18.)

MR. E. BRYAN DONKIN'S PAPER ON ROTARY ENGINES AND THEIR APPLICATION TO GAS EXHAUSTION.

The PRESIDENT remarked that engineers having anything to do with either gas or steam engines were greatly indebted to Mr. Donkin and his cousin; for no men had made a more serious and important study of several matters with regard to steam-engines than these gentlemen. The questions of generating steam, and superheating it before it entered the cylinder, as well as many others, had been experimentally tested by Messrs. Donkin with the best effect; and they had devoted time, money, and patience to satisfy the minds of other engineers on these subjects. In the second paragraph of the paper there was a reference to the very old Hero steam-engine, which was now frequently made in glass, and used as a child's toy. This was the earliest instance of anything that could possibly be found as representing a rotary engine. All engines driven by a fluid, whether gaseous or liquid, might be divided into two classes. One was the class in which the pressure of the fluid was exercised, as in the water-pressure engine, the ordinary steam-engine, and many other cases of that kind; the other, that in which the motor was worked, not by the pressure, but by the impact of the moving fluid on vanes which rotated. An important difference between these two classes of engines was this—that wherever an engine worked by pressure, it was necessary to have tight packing between the pressure and the exhaust side of the engine; this being carried out by packing the rings of the piston. It was comparatively easily done when they had a piston working in a cylinder, and the motion of the piston was parallel to the sides of the cylinder; but, on the other hand, when they had a part rotating piston, they required not only to have a sufficiently effective joint between the circumference of the cylinder and the rotating part, but also—and this was an extremely difficult matter—to get a proper joint between the rotating part and the two planes terminating the cylinder. In the case of an ordinary piston, the velocity of every part was the same; but in these rotary engines, the velocity of the circumference was so much greater than that at the centre, that wear and tear would be sure to occur more rapidly at the former place. This was certainly one of the principal reasons why all attempts to make a rotary engine with steam-tight joints against the ends and sides of the cylinder had failed. He had seen drawings of a great number of these engines, and had watched many of them in operation. Some worked very well at first; but, after a short time, from the cause he had mentioned, they became defective. It remained for a countryman of his own—a man coming from a distinguished lineage in science—to discover really the first practical rotary engine. He referred to the Hon. Mr. Parsons, son of the late Lord Ross, the eminent astronomer, and brother of the present Lord Ross, who was following in his father's footsteps. The contrivance he made, and the principle on which it depended, were these: It was found that whenever any moving body was actuated by the impact of a stream of steam, water, or other fluid striking upon it, the most economical result was reached when the vane attained half the velocity which the issuing fluid would have had if the vane had not been there to oppose it. To take a very simple example, supposing a man were walking along the street at the rate of four miles an hour, if another were walking after him at exactly the same rate, the latter would have no effect in pushing the former forward, because the first man would be going away as fast as the latter came up to him. On the other hand, if the latter knocked against a lamp-post in walking, he was thrown back, and the

whole of his power was turned into reaction. But, if one man were walking at the rate of four miles an hour, and came up behind another of the same weight, he could push him on. He would have lost two miles of his velocity, and the other man would have gained two—both moving at the same speed. Therefore it had been ascertained without doubt, theoretically as well as practically, that the best velocity for any engine working by impact was when the machine attained half the original velocity of the jet moving it. But how had Mr. Parsons overcome the following difficulty? Steam issuing from an orifice into the atmosphere, even at a pressure of 50 to 60 lbs., had an enormously high velocity. If there were vanes moving at half this speed with any ordinary size of rotating body, it would run to something like 100,000 or 300,000 revolutions a minute; and it would be almost impossible to get proper adjustment at such a rate. Mr. Parson's solution was, to his mind, an extremely ingenious one. Instead of having one turbine, he strung upon a horizontal axis a number of turbines. Steam entered the first turbine at 60 lbs. pressure, and escaped from it at 55 lbs.; it then entered a second turbine at 55 lbs., and escaped at 50 lbs.; it afterwards entered the next at 50 lbs., and escaped at 45 lbs.; and so on. So that, in each step of that movement, he was really using a difference of 5 lbs., instead of 60 lbs., of pressure. Even with this arrangement, the velocity was very high. He (the President) recollected visiting the works at Gateshead some years ago (Mr. Parsons was unfortunately absent, but his chief assistant was present); and they were then constructing one of these machines. He asked to be allowed to guess (before he was told) what the velocity of the machine ought to be; and he put it at 8000 revolutions a minute. The assistant said this was what they started with; but they had found that it worked more efficiently at 10,000 revolutions. Since that time Mr. Parsons had made some additional improvements; and instead of having all the turbines lying parallel to each other on the same shaft, he had a series of discs, and on each disc a series of turbines; so that, instead of being parallel to each other, they were arranged radially one outside the other. By making the discs larger, he had now been able to reduce the speed to 4000 revolutions a minute. He (the President) had seen one of these machines working a dynamo very beautifully indeed. The dynamo consisted of only a few turns of common bell wire carried endwise round a soft iron cylinder. The great advantage was that in dynamic machinery a very high speed was required; and thus, on the same axle, it was possible to start at that time with a velocity of about 10,000 revolutions. This had since been reduced to 4000 revolutions; and they now had in Cork a dynamo worked by one of these engines. This was a point which was often overlooked by engineers who did not take into account the relative velocity of a fluid working by impact, and that of the vane which was to receive it. He had himself been making drawings for another method in which this might be carried out; but as yet it was in too inchoate a form to enable him to give any details of the arrangement.

Mr. W. R. Chester (Nottingham) said they were all extremely indebted to Mr. Donkin for bringing this matter forward in so comprehensive a manner; and it became all the more interesting when illustrated by the ingenious mechanical contrivances which he had shown. There were various patents dated 1846, 1868, 1879, and 1892—all of which were modifications of each other, increasing the efficiency of the gas exhauster. He did not propose to criticize them particularly; but there was one feature in connection with the manufacture of mechanical appliances, such as exhausters and station meters, which he considered was a very disadvantageous one—at any rate from the point of view of the purchasers. It had been his experience on many occasions, after an apparatus had been put down, to test its efficiency, and see how nearly it came up to the standard quoted by the manufacturers; and he had frequently found that, although the apparatus when new would touch perhaps its highest efficiency—say, for half an hour—yet its total efficiency was overstated to the extent of 10, 15, or 20 per cent. When he made complaints of this kind, the invariable reply had been that the apparatus was never intended to work at its maximum capacity, but to touch it and then fall down considerably. This might be all very well from the point of view of manufacturers, in competition with one another; but it was totally misleading to customers who had to use the apparatus, and he thought it was a pernicious system to follow. A machine ought, in his opinion, to be capable of working at its maximum or stipulated capacity during any length of time it might be necessary in the course of its use. Another feature in connection with exhausters had often struck him; and it was this. It always seemed to him that the outlets of exhausters were exceedingly small in area in comparison with the quantity of gas they were designed to pass. At any rate on the inlet side, where the vacuum was small, there must be a considerable throttling effect in diminishing the orifice of the pipe to that of the inlet of the exhauster; and the same thing applied on the outlet. Scarcely anybody thought it sufficient to attach pipes to exhausters of the same area on the inlet and outlet side; but all, or nearly all, makers diminished these two parts to something like one-half the capacity generally considered desirable to connect up to the pipe. If Mr. Donkin had any figures illustrating this throttling effect, he should be glad to have the benefit of his experience. The advances which had been made towards perfecting exhausters, by Messrs. Donkin and Co., had been almost wonderful during the last ten years; and it had been his privilege on several occasions to take away small-capacity exhausters, and substitute larger ones designed by this firm—adapting them to steam-engines originally intended for exhausters of one-half the capacity. The whole gas profession were certainly indebted to Mr. Donkin for his ingenious inventions with this apparatus.

Mr. C. S. Ellery (Bath) said he agreed with what the President had said about the benefits Messrs. Donkin had conferred upon users of rotary engines. Mr. Donkin had called the exhauster the "heart" of the gas-works. This was an apt illustration; but he was somewhat afraid that, like persons who were not in perfect health, they thought sometimes a little too much of this useful organ; and that troubles which might be traced to other parts of the plant were sought for there. Thus they might be misled. As to the question of oscillation, he had possibly failed to grasp the significance of the diagrams; but, if he understood them correctly, they had been taken, not at the pressure on the works, but at 1 inch pressure of mercury. [Mr. Donkin assented.] They were told the oscillation at theoutlet was from 0·2 inch to 1·5 inches of mercury, or something like 650 per cent. with one particular type of exhauster. Now, as mercury was about thirteen times denser than water, the oscillation in an ordinary works' water-gauge would be between 2·6 and 19·5 inches. This was giving the exhauster rather a bad character; and, while he very much appreciated the increased efficiency they heard of in the new exhauster, he fancied some other explanation was required here. He should say that 0·5 inch on 20 inches pressure would be a considerable oscillation on the outlet of an exhauster working to its full capacity—the condition under which the diagram appeared to have been taken. But perhaps Mr. Donkin would explain. He (Mr. Ellery) had himself endeavoured to take a diagram of the working of a gas-exhauster, but had failed to get a satisfactory one with a steam-engine indicator. Trying all manner of springs, he found the friction of the piston was too great to allow of a diagram being taken on which they could rely; and he wondered whether or not this diagram had been somewhat vitiated by friction in the indicator piston. It might be of interest to mention that last winter he was desirous of knowing what difference there was in the efficiency of exhausters; and, having a duplicate arrangement (one having modern exhausters, and the other an engine fitted with exhausters which were not modern), he found that, by passing a given quantity of gas first through one and then through the other—indicating the amount of horse power required in each case—the newer type did the work with just 50 per cent. less power. So that it was important not only to have the best machinery, but to keep it in the highest state of efficiency. On one point he must join issue with Mr. Donkin, and that was the matter of bye-passing the gas. He had spoken in no uncertain manner on this point, and asserted that bye-passing gas was a clumsy way of overcoming the difficulty. He (Mr. Ellery) failed to see this entirely; but perhaps Mr. Donkin would instruct them in another and more perfect way. When they knew that gas-exhausters were constructed for the maximum rather than the minimum amount of work, and that the make of gas fluctuated, not only from month to month, but from week

to week and hour to hour, and even from moment to moment, he failed to see how to regulate the exhauster so as to keep a proper gauge simply by manipulating the steam. Take a works with a 60,000 feet exhauster, where the make had fallen to 20,000 or 30,000 feet, or less than half its full capacity. If the exhauster were slowed down to this speed, his experience was that the gauge would show anything but a satisfactory line; whereas by bye-passing some gas the exhauster did more satisfactory work, and maintained a more steady gauge in the retort-house. He did not know if this were so, but perhaps Mr. Donkin had an improved means of regulating the engine, so as to adapt it to the fluctuations in the quantity of gas coming from the retorts. After a series of experiments, he found that to ascertain the efficiency of the exhausters, they had to take the meter very frequently—about every five minutes or less—to learn the rate of the passage of the gas, because, especially where machinery was employed, the gas flowed very much more rapidly through the pipe at one part of the hour than it did at another. In other words, the exhauster had to run much more rapidly just as the charge of coal was going into the retorts than later on; and, for his own part, he had failed to keep a satisfactory gauge, unless the exhauster was running pretty well up to its speed. To accomplish this purpose, when the make of gas was small, it did not appear to him to be a clumsy way to open the bye-pass, and allow some gas to be churned round. The efficiency was given at 33 per cent.—in other words, by bye-passing the gas, something like 33 per cent. more steam was used. They had indicated the engine to learn for themselves what was the loss; and in actual practical work, he found that 20 per cent. was about the figure. He did not think that in a gas-works 20 per cent. more steam doing exhaust work in the time of smaller make of gas was a very serious matter, compared with the greater efficiency in the retort-house. He would suggest to Mr. Donkin, in some future experiments to confirm some which he had been making, that a diagram taken in the retort as well as at the inlet of the exhauster was necessary to determine the conditions under which the plant was working. He had taken many hundreds of diagrams from the ascension-pipe, and found that, by thinking too much of the "heart" of the gas-works, or the exhauster, and forgetting other parts of the body—viz., the ascension-pipes or the retorts—they were sometimes a little misled.

The PRESIDENT asked if any gentleman present had had experience of working exhausters by gas-engines.

Mr. W. W. HUTCHINSON (Barnsley) said that he had not; but at the same time he should like to corroborate Mr. Donkin's statement that the regulation of the pressure by bye-passing the gas was rather a clumsy way of effecting the purpose. He thought it should be the function of a separate vessel of some fair dimensions, and with sensitive working parts, which would respond readily to every pulsation; thereby diminishing the irregularity experienced wherever an exhauster was employed.

Mr. G. R. LOVE (Dundalk) stated that gas-engines were employed in his works; and he was surprised not to have heard more said about their use as driving power, more especially when all were so anxious to encourage the use of gas. At Dundalk, there was one of Crossley's 3½-horse power engines driving an exhauster; the cost of gas, at the selling price of 4s. 7d. per 1000 cubic feet, being only about 2d. an hour. Their make was 30 millions a year. This exhauster worked for twelve years with very little repair. It was one of the old side-valve pattern. He had lately had it repaired for the first time; and it was still working and giving good results. About a year ago he obtained a 3½-horse ignition-tube gas-engine, and found that, at 4s. 7d. per 1000 cubic feet, it did not cost 1¼d. to drive his exhauster, which was one of Beale's, made by Messrs. Gwynne and Co. He found he had a perfectly level gauge when working with a gas-engine, and had no difficulty whatever. It was handy for starting and stopping; and on Sunday, in a small works where it was necessary to shut down, it could be stopped, and needed no attention.

The PRESIDENT said he presumed Mr. Love did not mean to say that 4s. 7d. was the cost of the gas.

Mr. LOVE said he did not; that was the selling price.

Mr. H. LEES (Hexham) said it had been his experience, for the past two years, to have charge of works where a gas-engine was employed for driving the exhauster. The engine had been in use for ten years, and was not of the most modern type. The cost in his case was not quite so low as that just mentioned by Mr. Love. Taking gas at 3s. per 1000 cubic feet, the expense per hour came to nearly 1½d.; but, even at that price, he thought it was considerably cheaper than steam. The cost of the fuel itself would cover that of the gas; and there would be the labour in addition. The gas-engine was quite equal to what it was called upon to do; and there was no difficulty in ensuring regularity of working. It was looked after by the stokers; and all that it required was regular cleaning. The foreman attended to this; and, of course, if it were neglected, the wear and tear would be greater. For works making from 20 to 30 millions per annum, he did not think any form of motive power would be so economical. In addition to driving the exhauster, the engine supplied the power for the liquor-pumps, and for pumping water for retort-house purposes.

Mr. J. CHADWICK (Oldham) testified to the great interest of Mr. Donkin's paper. He agreed with him in saying that keeping the speed of the exhauster regular by bye-passing the gas was a clumsy device. He believed there was formed some amount of hard substance, of a pitch-like character, which materially affected the working; and if they had an exhauster running at something like 60 revolutions per minute, and if at a certain portion of the day 50 revolutions would be sufficient, he did not see why it should be worked at 60. It was just as easy, and more economical, to lower the speed of the engine, and so reduce that of the exhauster, than to keep working at a high speed, and "churn up" the gas over and over again.

Mr. J. STELFOX (Belfast) expressed his agreement with Mr. Ellery on the subject under discussion. He said he could not see anything clumsy or wrong in the bye-passing system. If this was heterodoxy, he must plead that he had tried the orthodox plan with very unsatisfactory results. Having been called out of the room several times during the reading of the paper, he had unfortunately not heard the whole of it, and only gathered the substance of it from the subsequent discussion. He had just asked Mr. Donkin if he could completely regulate the exhauster from the steam inlet; and that gentleman said "Yes." He therefore told Mr. Donkin that he should give him an opportunity of proving his ability to do this as he had done in other cases. If regulation by a steam throttle-valve only could be depended upon, nothing else was required; and he did not at all see why there should be two sets of apparatus to do one piece of work. He did not believe that the two systems would work well together. He had, in fact, made the experiment by having the bye-pass adjusted to give a level gauge with the steam at a low pressure. The steam pressure was then gradually increased; and this caused a corresponding increase in the speed of the engine. But inasmuch as the bye-pass at once responded, and maintained a level gauge in the mains, there was no change of pressure to act on the steam regulator. The experiment was continued till the engine, which at first was running at about 40 revolutions per minute, had reached nearly 80 revolutions—the gauge keeping very steady all the time. It seemed, in fact, that this action might have been continued to any extent, so long as the bye-pass area was sufficient to afford the necessary amount of compensation. It must follow, therefore, that it was a question whether there should be a steam-regulator or a bye-pass regulator; for he certainly did not see how to apply both. As regarded the steam-regulator, he found that, when in operation (and he tried it two or three times), it seemed quite impossible to depend upon it for a moment. The slightest movement of the steam-valve immediately gave a great increase of speed, and "racing" was set up, which apparently could be continued for any length of time if the apparatus were sensitive. He did not think the "churning" of the gas could be of very serious moment. In their exhausters, they used nothing but tar oil, which cost from 2½d. to 3d. per gallon, for the lubrication of the internal parts; so that any tendency to form pitch was prevented. That was dealing with foul gas. In most cases there was a man in attendance in the exhauster-room; and he (Mr. Stelfox) could not see anything simpler, if an engine running at 60 revolutions per minute had to be brought down to 50 or 40, than for the attendant to check the speed by means of the main valve. He admitted there were other questions involved, such as the wire-drawing of steam, &c.; but, after all, steam was not such an important factor that they should sacrifice efficiency to save a little of it.

Mr. J. R. Smith (Padiham) remarked that one point which had not come out clearly in the discussion was the reason for the bye-passing. He took it that the reason was the difference between the maximum make in winter and the maximum make in summer; and it was in summer that the bye-pass was required. It was fifteen years since he settled what form of exhauster should be put in; and he remembered that his Committee were at the time very much exercised as to what class to use. They came to the conclusion that they must have something which was efficient; and something which could be adjusted and was safe. They acknowledged that this was a clumsy way of doing the work—churning the gas over and over again; but after fifteen years' experience—he had not seen any reason to alter his opinion. In the summer, he worked with 6 retorts, and with from 50 to 60 in winter. Taking the year through, his churning of gas over and over again was a safe and convenient method. In their case, very little lubrication was required, because if foul gas were pumped, there was sufficient lubricating material in it.

Mr. W. Davis (Poole) said his was only a small works. Three years ago they decided to convert their liquor into sulphate; and, in order to do this, it was necessary to have some steam appliance. He had a boiler working the steam engine and pump; but he was afraid it would not be large enough to supply the necessary steam for the conversion of the liquor. He had not room or convenience for putting in another boiler; and he went to the expense of erecting a gas-engine—putting in one of Crossley's 4-horse power "Otto" engines. He had therefore had experience both of steam and gas. He had not a word to say against the use of gas-engines; but he had a great deal more difficulty in working his than he had had with the steam-engine. In the first place, the regulation of the speed was very limited. Some regulation could be made, but not much. Up to the maximum make, the engine might do the work very well without much gas being bye-passed; but when they came to a small make, the bye-pass must be extra large, because it could not be regulated with the gas-engine. This disadvantage was entirely overcome by the use of a steam-engine. Subsequently, he found, after he had brought the sulphate plant into good working order, that, by working up the liquor in the summer, the steam boiler and engine were sufficient; and for this reason he had not used the gas-engine to the extent he had anticipated. However, he had it as an auxiliary, in case anything went wrong with the boiler or steam-engine. He would not recommend any manager of small works to rely entirely upon a gas-engine, if he could have steam.

Mr. H. Wimhurst (Sleaford) said he had for the last eleven years employed a 3½-horse power "Otto" gas-engine to drive his Beale exhauster of 7000 cubic feet per hour, the regulation of which was through a Fison regulator. He should like to ask those present how they checked the speed of the exhauster. With the Fison regulator, he had a very even gauge, both in summer and in winter; and there was no difficulty in dealing with the increased or decreased make of gas. The engine had been running night and day since it was put up, and had not cost £20 for repairs. They had taken down the steam-engine, and erected the gas-engine. Given a really good gas-engine in duplicate, he should desire nothing better to drive an exhauster through a Fison regulator. Besides driving the exhauster, the engine worked two ram liquor-pumps and a Waller coke-breaker. The engine was stopped for about an hour each week for cleaning. The cost for gas was 1·25d. per hour.

Mr. P. J. Salmon (Galway) remarked that he had found great satisfaction in running his exhauster with a gas-engine—cleaning it about once a week. One could not have anything better for small works.

Mr. Love said there was not the slightest difficulty in running a gas-engine and regulating the rate. It was possible to increase the speed of one of the old type by putting a weight on the top of the governor, or, if it were an ignition-tube engine, by adjusting the screw.

Mr. Davis said the makers told him this could not be done; and he had tried it.

Mr. Chester said he rose to anticipate a portion of Mr. Donkin's reply, as it might be desirable so far as an independent engineer's opinion went, to set at rest the minds of Mr. Ellery and Mr. Stelfox as to the bye-pass and the regulation of the steam-engine. During the last two or three years, he had put down a number of exhausters and regulators supplied by Messrs. Donkin; and the steam-regulator to which no bye-pass was attached was the most perfect arrangement he had ever seen for controlling the speed of the engine, and regulating to a nicety the vacuum on the inlet side of the exhauster. It left nothing to be desired. He advised all those who had any trouble in regulating their engines to adopt some such system as that Mr. Donkin had brought out for this purpose.

Mr. Donkin, in answer to Mr. Chester as to the size of the ports of the exhauster, said they were just double what was necessary. When an exhauster was at full speed, one half of the port could be blocked without creating any pressure or vacuum. This would not apply to the size of the inlet or outlet mains, in which one had to take account of the friction, and the liability to be stopped up with tar. With regard to the regulator question, Mr. Chester had just answered it for him; and he was much obliged to him for what he had said. He agreed with Mr. Stelfox that a steam-engine regulator would never work with a bye-pass regulator. With respect to Mr. Ellery's question as to pressure, he would remark that the diagrams were taken from an indicator which was connected in such a way that the line represented the pressure in the exhauster itself, not on the outlet-gauge. The variation on the gauge was from 0·9 to 1 inch. They had also a water or mercury gauge in the same place as the indicator; and this showed a great variation in the same manner. The spring was very delicately adjusted; and they took great care to make it as frictionless as possible. The experiment was repeated several times; and he did not think there was any mistake in the diagram. He should be pleased to show it to Mr. Ellery at any time.

The President said they were much obliged to Mr. Donkin for his interesting paper and diagrams. In regard to regulating steam-engines, it was nearly thirty years since he invented an arrangement which he called the "brake and tappet" motion, which worked with a fine tangent screw, and made the opening of the steam-valve extremely slow. The result was that he watched the gauge for five hours; and it never showed a variation of ¼ inch. This was entirely controlled by the main valve on the steam-engine. He should be happy to explain it to Mr. Donkin at any time, and should be glad if he would take up its manufacture. It had since been twice patented—first by someone as a governor for a steam-engine, and still more recently by Messrs. Manville as a regulator for dynamos in connection with accumulators. Reference had been made to this last form in Sir David Salamon's very useful book on the "Management of Accumulators."

Mr. D. Terrace's Paper on the Setting and Working of Inclined Retorts at Middlesbrough.

Mr. R. Mitchell (Edinburgh) asked if Mr. Terrace had had any experience with Wigan cannel, or such cannel as they had to use in Scotland, because he was afraid that, at the angle at which the retort stood, the mouthpiece would be choked if working with good cannel, while the end of the retort would be empty. He also wished to know if Mr. Terrace had tried placing the ascension-pipe at the other end of the retort. It seemed to be against all scientific principles that the ascension-pipe should be fitted at the lowest end—causing the gas to creep over the highly-heated surface of the coal, more especially towards the finish of the charge. He feared there would be decomposition of carbonaceous matter, and consequent loss of illuminating power.

Mr. H. Ashton Hill (Wallasey) said they were much indebted to Mr. Terrace for the great trouble he must have taken in preparing the paper, and especially the diagrams illustrating it. He probably had not had the system in use sufficiently long to be able to give an opinion as to its working; but he might perhaps say, in his reply, whether he would recommend others to adopt it. The first point that struck him was about the kindling. He did not understand why, in starting the regenerator, a plate was put at the bottom of the producer. His own practice had been to light a small fire at the bottom, and draw plenty of air through, so as to make sure of converting the carbonic oxide into carbonic acid; and the products of combustion, in passing off, gradually heated up the setting. Mr. Terrace stated that by his system he could carbonize 30 cwt. of coal per 20 feet length of retort; but he (Mr. Hill) did not see any great improvement in that. He found that,

with a 9-feet single retort, he could carbonize 1 cwt. 2 qrs. 6 lbs. per foot; so that this plan worked out 1¼ or 1½ per cent. less than he was doing at present. It had been said that figures could be made to prove anything; and he thought those which were given by the author at the end of the paper could be trimmed down to show a very different result. It was, of course, quite right for Mr. Terrace to state his own experience; but the labour on the ordinary system should not be put down at 3s., and that on the inclined retort system at only 1s. 6d. per ton—thereby making a saving of £1200. It had often been said that by machine charging the wages for carbonizing could be brought down to 1s. 6d. a ton; so Mr. Terrace's figure did not seem to be any improvement on that. From what he saw at present, he should not feel inclined to recommend his Committee to take up this system. They were now designing new works to make 1½ millions per day, and were erecting a retort-house for horizontal charging; and he could not see his way to introduce this extra machinery unless there were some great advantage to be derived from it—more, in fact, than had been shown. There was always wear and tear with machinery, and also expense for upkeep. Then there was, he thought, an objection to the men working in the fumes, above and below. This seemed to him to be a move in the wrong direction. As to its being a means of avoiding labour troubles, he thought they sometimes looked at these things in more or less of a sentimental light. In works where they made 20 millions a year, and employed twelve men, it was very different from a case like that of The Gaslight and Coke, or the South Metropolitan Gas Company, where thousands of men were regularly engaged.

Mr. T. Bower (West Hartlepool) said he did not know that he could add much to what Mr. Terrace had said, as he was only just commencing the erection of a bed of retorts, which he hoped to have at work next winter. His reasons for going into this matter were somewhat similar to those of Mr. Terrace. In the first place, he could not get down much below the ground-line on account of water; and therefore he had to turn his attention to something he could put above ground. He went to see most of the installations of inclined retorts which were at work; and it was not without very careful thought that he recommended his Directors to adopt this system. They had in view entirely new works to produce about 3 million cubic feet of gas per day; but it was desirable first to somewhat improve the make at the present works, which were equal to 1½ millions daily. It was thought they should increase the carbonizing plant to something like 2 millions; but he could not satisfy himself as to how this could be done without taking down an old single retort-house, and making it into a double one. This was not quite satisfactory for horizontal retorts; and so he decided to adopt the inclined system. His setting would be somewhat similar to that described. One of the main difficulties he had to confront was the heating of the retorts. He saw several systems at work, some of which seemed fairly good at one time, and not nearly so good at others. Being very close to Middlesbrough, he often went over there to see what Mr. Terrace was doing; and he could say, without fear of contradiction, that better heats he never saw anywhere. He did not expect to get the same advantages as Mr. Terrace had done, because his settings were very antiquated; and he should be satisfied if he effected half the saving which the author of the paper had mentioned. He (Mr. Bower) had had seven years' experience of carbonizing somewhat similar coals to those Mr. Hill would be using; and there was a considerable difference between the soft Durham coal and that employed in Lancashire. Working in Durham as nearly as he could under the same conditions as in Lancashire, he could not obtain the same results per mouthpiece within 20 per cent. He mentioned this because managers who had only had experience of Lancashire coal might otherwise think they were not doing so well in Durham as they ought.

Mr. Hill remarked that he had worked with Lancashire, Welsh, and Staffordshire coals—all soft coals.

Mr. Bower said he had no doubt Mr. Terrace had based his calculations upon the very soft coal to which he had referred. There was also a difference of from 15 to 20 per cent. in the results per mouthpiece between using screened and unscreened coal from the same colliery in the same retort-house; but, on the other hand, there was the question of the difference in the price of the coal. It had been suggested that an equal saving might be obtained by machine stoking. He quite admitted it; and he considered this point very carefully before deciding on inclined retorts. His retort-house, however, was not at all suited for machine stoking, as it was not wide enough. It was intended to obtain what experience they could in the small house, preparatory to erecting the larger one at the new works; and at some future time he hoped to be able to state the exact results. They intended to have three furnaces on Mr. Terrace's system, and three on Mr. Winstanley's, because he could not quite make up his mind which of the two was superior to the other; and he thought the best test would be to have the two systems working side by side under the same conditions.

Mr. A. T. Fletcher (Leigh) said he had listened with much pleasure to Mr. Terrace's paper; and having had something to do with inclined retorts, he should like to give one or two figures bearing upon them, which he thought had not been collected by anybody connected with inclined retorts. Similar circumstances to those which compelled Mr. Terrace had compelled his people at Leigh to adopt inclined retorts. They wanted to get increased carbonizing power, and the question was how to do it. They had erected seven beds of sevens, set three vertically and one in the centre; so that they had three centres (not four, like Mr. Terrace), 21 inches by 15 inches, and 12 feet long. With 12-feet retorts, they found they could have two rows in the same house, which was only 54 feet broad, so that there was considerable economy of space. By putting in inclined retorts, they had double the carbonizing power of any other style of retort-settings they could have procured. He should like to say, while he had it in his mind, with regard to Mr. Mitchell's question about the Wigan cannel, that they were in the very heart of the Wigan coal-fields, and knew something about this cannel. They used Abram cannel which was very rich, and also four other kinds of coal. As to taking off the gas, they did this at the top; and with these classes of coal, they had not been the least troubled with the ascension-pipes. With reference to the question about having to employ skilled labour, the precise advantage which he saw in connection with inclined retorts was that any gas-works labourer could be put on the work. They were not bound to have a man who could use a spade. They found it to be a difficult thing in the depth of winter to get extra men to charge the retorts; and a great deal of loss was incurred in this way with the horizontal retorts. With the inclined system, however, anybody could do the work which had to be done. Mr. Terrace had given the cost per 20-feet retort (with regenerative furnaces) at £100. This, worked out in a comparative ratio, would be £60, while theirs at Leigh cost £51; so that their figure was a little lower than that given in the paper. The cost of labour worked out on a week, night and day (they paid time-and-a-half for two shifts on Sundays), was 1s. 9d. per ton, as against 2s. 7d. on horizontal retorts; and this included total retort-house labour. But they had no storeage-hoppers at the top—simply measuring chambers. They were going to have storeage-hoppers; and the expenses would be considerably reduced, as, by elevating in the daytime they would have the advantage of having the coal tipped direct from carts into the breaker. He thought that the expenses then would be 1s. 4d.—certainly not more, as far as he could see—instead of 1s. 9d. per ton. They had used altogether, in the inclined retorts, during the past winter, 3000 tons of coal; and since January they had carbonized 2000 tons in inclined retorts alone, and none in horizontals. The tar produced per ton of coal in inclined retorts was 1·27 cwt., while the horizontal retorts gave 1·22 cwt; so that they had even a little more tar with the inclined than with the horizontal retorts. The illuminating power was the same. They used the same proportion of cannel in both cases; and he had never seen any difference in the results. The top retorts were set at an angle of 32°; the middle ones, at 31½°; and the bottom ones, at 31°. The producer was inside the setting; and he did not find any inconvenience from clinker.

Mr. J. West (Manchester) said the subject now before the meeting was one in which he had been greatly interested for a long time, and on which they had all been anxious to get as much information as they could. They had had a certain amount of information from various gas-works, which did not always agree; but they had never before had such a practical return of actual results. He was pleased

to see that Mr. Terrace had given in one figure the cost of carbonizing; taking the coal from the store to the tipping of the coke in the yard. Some London gentlemen gave a few figures, in which they simply took the men who pulled the lever to drop the coal into the retorts; but on this one could not base any calculation. Mr. Terrace gave them in detail the number of men, and what they were doing. He also stated that he could not possibly work machinery in those houses, nor could Mr. Bower, or probably they would have adopted it in place of the inclined retorts. This was often the case—that retort-houses were too small for mechanical stoking. He was glad to find, however, that they did not altogether dispense with machinery. Some of it looked complicated, but perhaps it was not so really; and if it were thoroughly well made, it would keep in order for a long time. He noticed that the constructors of this particular plant had paid him the compliment of including a diagram of his coal-breaker amongst their patented machinery, and placed their own name upon it. Mr. Terrace appeared to anticipate further reduction; and, though some would perhaps rather rely on what he had already accomplished, he should not be disposed, knowing what machinery could do, to put a limit to the reduction of cost by this means. He would probably reduce the cost still further; but he (Mr. West) doubted if he would do so to the extent he imagined. He would ask him to take particular notice of what he accomplished with his large installation, and at some future time give them the benefit of his further experience. Dealing with 36 tons per day was pretty well for an experiment; some would be inclined to call it actual working. As Mr. Hill had said, it was nothing unusual to charge a retort of the size named with 7½ cwt. of coal; with power machinery, they could charge a smaller retort with a much-larger quantity. He (Mr. West) should not question the calculation Mr. Terrace had given of the cost of the two systems; but there were a few points wanting further elucidation. He asked some Scotch friends of his if they would investigate one or two matters for him, and state the quantity of gas they were making and the cost per ton of coal carbonized; so that they might have some idea of what was being done by comparison with machinery on the horizontal system, for this question had never been satisfactorily answered up to the present time. The next important thing was as to the illuminating power of the gas. He had an idea, with Mr. Mitchell, that some of the hydrocarbons would be burned up, and that the same illuminating power would not be obtained from an inclined retort as from a horizontal one. There was also a question as to the quantity of fuel used, which he hardly thought had been fully answered, except that Mr. Terrace thought it was about the same as with the ordinary generator furnace on the horizontal system. Their thanks were due to Mr. Terrace for the thoroughly practical manner in which he had brought this matter forward. He said he now effected a saving of 1s. 2d. a ton, and hoped to save 1s. 6d. He did not think he would be able to show any saving of fuel and labour on comparing this system with the horizontal and hand-power machinery, because with the manual machine they could carbonize for from 1s. 4d. to 1s. 7d. per ton. There was a further question, to be answered later on, as to the durability of the retorts; and he fancied there would be more wear and tear with the inclined ones. If a retort-house were large enough to apply machinery thoroughly, the cost of carbonization could be reduced as low as 9d. per ton, as had been proved by experience.

Mr. W. R. Chester (Nottingham) said he noticed that one of the things which induced Mr. Terrace to adopt this system in preference to extending his plant on the old lines was the advantage usually claimed for it—viz., that on the same ground one could get an increased production of gas. Mr. Terrace said that he carbonized with 20 feet through retorts, and 7½ cwt. per charge, which was equal to 30 cwt. during the 24 hours; but he (Mr. Chester) did exactly the same with the horizontal system. He had seen a number of the inclined retorts at various works where the principle had been carried out of producing the largest possible quantity of gas in the smallest possible retort-house area; and the result had been a gradual process of roasting the stokers. The conditions under which he had seen the work carried on were simply outrageous; and no one ought to be expected to work in the ovens in which some inclined retorts had been erected. The expense of carbonizing was put by Mr. Terrace at 1s. 6d. per ton, which was a considerable diminution from the original cost; but, on looking carefully into his own figures, working with horizontal retorts and hand labour, he found the cost was: For stokers' wages, 5s. 3d. per day, or 1d. per cwt., equal to 1s. 8d. per ton; firemen's wages, 2d. per ton; coal wheelers, 5d. per ton; coke wheelers, 2½d. per ton—making 2s. 5½d. per ton, or an increase of 10d. on Mr. Terrace's figure. The advantage over the horizontal system, in combination with a good type of regenerator furnace, was 10½d., not 1s. 6d. per ton; but with the aid of machinery, and a first-class regenerator setting with horizontal retorts, his conviction was that the reduction would exceed that which was possible from inclined retorts. So far as the regenerative furnace was concerned, no doubt Mr. Terrace would get excellent results; but it would be unfair to credit the inclined system with advantages which ought to be credited to the principle of gaseous firing. In his own case, the advantage of regenerative furnaces over the old system of direct-fired retorts worked out to something like 2s. per ton of coal. There was due to the regenerator a considerable diminution in fuel, in labour, and in wear and tear of the retorts. This was a matter which gentlemen who had not given attention to regenerative firing would do well to consider.

Mr. W. A. Valon (Ramsgate) remarked that much of what he might have said had already been stated by previous speakers; but he must congratulate Mr. Terrace on the simple, straightforward way in which he had put the matter before the Institute, and on his remarkably clear and excellent drawings. He (Mr. Valon) was unable to modify the opinion which he expressed last year—that, at present, he did not see any advantage in the new way of setting retorts. As far as machinery was concerned, it required quite as much as—indeed, more than—was wanted for horizontal retorts. Several gentlemen had given, as a reason for introducing this system, the limited space in their retort-houses. This was a legitimate reason. They must all bow to circumstances; but, so far, he did not see that it offered any economy or any convenience over the old method. For many years, machinery had been employed at more than one works with which he was connected; and there they found that carbonizing could be done at an average of 1s. 6½d. per ton of coal. It was the experience of twelve or fourteen years; and, as far as he could ascertain, this figure had not yet been reached by Mr. Terrace. He did not quite see how it was possible to put a number of inclined retorts in a smaller space than if they were horizontal. He could understand there not being sufficient width to work them; but that the absolute ground on which a certain number of retorts stood could be less, he could not understand. He had just ascertained from Mr. Terrace that the size of his arches was 7 ft. 10 in. by 7 ft. 6 in.; and this would be large enough, under ordinary circumstances, to take more retorts on the horizontal system than were shown in the drawing. If other gentlemen would state their results in the same clear way, there would, before long, be no room for doubt as to which was the better system.

Mr. Terrace, in reply, said the discussion had brought out one or two points upon which he had not touched in his paper. For instance, he had not referred to cannel coal, about the carbonizing of which Mr. Mitchell wished some information. He had not had any experience of the use of cannel coal in inclined retorts. He had no doubt, however, that, given the proper angle, what Mr. Mitchell seemed to fear would not take place—that was to say, the charging of cannel could be controlled in such a way that it would not have a tendency to rush towards the bottom end. Experience alone could determine the angle, &c. As to the ascension-pipes, these were first put at the top; but he used the small old ones that had served the 9-feet retorts. He had since learned that the bottom was the better place at which to take off the gas. Regarding the decomposition of the gases, he did not think there was anything to apprehend in this respect, as, the whole retort being fully charged with gas, the "creep" downwards did not seem to be any greater detriment than if it were upward. The one-tenth of additional pressure at the high part of the retort was all they had to take into account. Mr. Hill had alluded to the first lighting of the producers. It was preferable to start them by the means described than the plan mentioned by him, which might result in an accumulation of furnace gases in the setting

proper. They should certainly avoid the possibility of any gases gathering there, otherwise there would be an explosion. As to the quantity of coal carbonized per foot run of retort, mentioned by Mr. Chester, he did not say that they had gained anything in this respect over the old working, when, the heats being equal in both cases, the production per foot run would be about the same. With his good regular heats from the regenerative furnaces, he was able to carbonize relatively more coal than he could by the old furnace. In respect to machine stoking, referred to by Mr. West, he purposely avoided taking it and other methods into account; so that the paper might bring out a rigid comparison between the old hand, and the inclined system. However, he had some figures in connection with machinery in a town where twenty-four through beds were at work; and there the hand labour was reduced from 2s. 4d. to 1s. 8d. per ton of coal carbonized. The latter rate appeared to be common to the inclined retorts, and also to stoking by machinery. It depended upon the circumstances in which one was placed which system should be adopted. Mr. Bower had specially mentioned the class of coal that had to be dealt with. The Durham coal was more difficult to carbonize than the kind alluded to by Mr. Hill, or the Yorkshire coal Mr. West had referred to. Working the same quantity in a smaller bed, it all depended upon the class of coal used. He would be very pleased to give further experience with his complete plant in future discussions. Mr. Leather, of Burnley, would have been able to give the results of his fuller experience; but he was unavoidably absent. Mr. Chester had referred to the close heat in the retort-house on the charging-stage between the beds, of some settings of inclined retorts. He had a central bench, which, being open to the air on each side, had not this objection. Regarding the amount of fuel used, he purposely kept his paper free from controversy on such points; as to state it by the quantity of coke used per 100 lbs. of coal carbonized, or the percentage on the quantity of coke made, he thought might be misleading, as apparently each manager had his own particular way of calculation and statement. With respect to the question of space raised by Mr. Valon, all the difference gained was about 15 per cent., or the difference between 17 feet on the horizontal and 20 feet on the incline; but if they took the cubical capacity—the height and the floor space—they obtained more in this way. In his case, they had, by raising the walls, secured an additional floor for charging the retorts; thus saving actual ground-space to this extent—saving what the machines would take up.

The following remarks upon the subject of the paper have been forwarded for incorporation in our report of the discussion:—

Mr. J. P. Leather (Burnley) writes: As one who has had inclined retorts at work for some time, it may perhaps be interesting to give my experience. We commenced by a small installation of four beds (afterwards increased to eight) of 21 in. by 15 in. retorts, 15 feet long, set seven in a bed. It was our first experience with regenerative furnaces; and within a month the arches over the combustion chamber were melted down, and had to be rebuilt. It cannot be said that our first experiment was a success. The ascension-pipes were placed at the lower end of the retort; and we found a considerable accumulation of tar in the lower mouthpiece, which caused great annoyance to the men, besides being a loss. We found it impracticable to deal with it by collecting it, as it became pitch when cold. These lower mouthpieces were reduced from 21 in. by 15 in. to 18 in. circular, which was a great mistake, as the coke choked in the mouthpiece. The charging also was not at all a pleasant job for the man who had to be on an upper stage to manipulate the charging-trolly, where he was subject to the smoke and heat from the open mouthpieces below him. We nevertheless saw, in spite of our difficulties, that success was possible; and we determined to achieve it. We have therefore now erected eighteen beds of sixes, in two rows of nine each, back to back, with a centre passage between for charging. In these we have a bottom mouthpiece the full size of the retort, but only 5 inches in length from flange to face. The retorts are 24½ in. by 16 in. The greater part of the coke will not unfrequently come out of the retort without "tickling." The ascension-pipes are 8 inches in diameter, and are taken from the upper end of the retort. The charging is done from an overhead tank by means of levers and measuring hoppers, as proposed to be erected by Mr. Terrace. I ought, however, to mention that the retort-house has a stage-floor; and the furnaces are therefore at the front, and are fed with hot coke direct from the top retorts. The difference in the cost of inclined and horizontal retorts in our case will, I think, not be so great as that given in the paper. Mr. Terrace's retort-house, though only 51 feet wide, appears to have contained retorts 18 feet long, which he replaces by inclines 20 feet long. We built a new house 75 ft. 3 in. span, or only 5 feet greater than I should have built it for horizontal retorts 20 feet long. The roof is 32 ft. 10 in. span to the eaves, or only about 4 feet higher than necessary for horizontal retorts; our storeage-tanks and conveyors for coal being in the roof above the tie-rods. We have, however, two sets of 15-feet retorts, or 30 feet of retort, where we should have had 20 feet only of horizontal retort—that is, with a house 20 per cent. larger, we have 50 per cent. more retort. We ought, however, to have had a greater distance between the two sets of beds; the present space of 15 feet being too small for comfortable working, particularly in summer. We have not yet succeeded in carbonizing as much coal per foot of retort as Mr. Terrace has done; our charge per 15-feet retort being 4½ cwt. For eight beds of sixes, there are two men who draw and charge, one man to the furnaces, and another to wheel out the coke, working eight-hour shifts. Each man is paid 5s. 4d. per shift, which works out to 1s. 5·7d. per ton. As, however, my cost of carbonizing with shovel-charging (including wheeling in the coal) is only 2s. 3½d. per ton, I cannot show the saving stated in the paper. I hope, however, to be able to increase the weight of the charge to 5 cwt., when the saving, compared with horizontal retorts, will not be less than 9d. per ton. This will pay a good interest on the extra outlay, and, what is equally important, will reduce the amount of labour, at the same time simplifying its character. I have found that men who have never stoked before can in a few days work inclined retorts as well as, if not better than, our old stokers.

Mr. G. Winstanley (Coventry) writes as follows: The various speakers against the system of inclined retorts have adopted a line of argument which will not, I think, hold good. They seem to take for granted that the system is a failure, because, to their thinking, it has not succeeded so well as was expected; and they base their ideas in accordance with what they have either seen or heard has taken place in a few of the erections put to work in the earlier stages of its introduction into this country. Now, I would ask: What happened with regard to stoking machinery on its first introduction? Were the machines successful? If we look at the matter carefully, we find failures on all sides; and strong efforts were used to make these machines work satisfactorily. What became of them? Improved forms followed, to go the same way; and so on up to now. The best forms of the present day are still found to require alterations, to enable them to more successfully do their work. So we see, even under the head of stoking machinery, the acme of success not yet achieved. I mention this to show that the beautiful mechanical machines we have had placed before us for our use have had to step bit by bit up to their present state of efficiency; so that it is only by practical means that we are enabled to arrive at the desired end, and why should this not apply to the inclined system of retort-setting? So far, in the hands of several gentlemen, very successful erections have been accomplished. There is still room for further development; and, as time goes on, we may look for this system becoming more established. I believe it will grow in favour, and progress to an extent not expected by some of the speakers. I am more convinced every day that the system is a right one. There are a few minor details connected with it which need attention; but these are of a trifling nature. The great thing in its favour is the economy and simplicity of the machinery and the ease of working, with no delicate parts to get out of order, no skilled mechanic needed, no stopping work and returning to the old form of stoking owing to a breakdown of the machines. Under this head, the repairs are practically *nil*. The manipulation of the whole is simple, and any man can perform the duties. From practical working, we find that the slight alterations necessary can readily be adjusted. We shall see, when the various installations now under

erection are working, how far progress has been made. I am pleased to hear from those erecting, and from other speakers, that they have faith in what they are doing. Mr. Terrace is to be heartily congratulated for bringing his experience before the meeting; and I wish him the success he deserves. The prime reason of its introduction into my works was the difficulty experienced in getting labour for the lower class of work. This has been very great during the past few winters; and it increases year by year. Then there is the fixity of site; and I am bound for some time to come to make the present one do for our requirements. Hence the need to increase the power of carbonization upon the same confined area. This has been done by converting existing arches into regenerative settings; and, during the past fifteen years, we have doubled our manufacturing power in the same space, so that at the present time, by the addition of an erection of inclined retorts on a space occupied by old settings, together with our remodelled horizontals, we have a power equal to 3,500,000 cubic feet per diem, and a surplus of another 500,000 cubic feet in case of emergency. Now, without this inclined system, we could not have gained the carbonizing power named, in our confined spaces. In this respect alone, the system is worth every consideration. Taking the weight of charges, referred to by several speakers, I may say that we carbonize 30 cwt. of coal a day in a 15 feet length of retort, working six-hour charges; but if working shorter charges (say, four-hour), we should carbonize 45 cwt. I am free to maintain that we can get a greater quantity of gas per foot of retort area with the inclined retorts than with the horizontal. Mr. Chester referred to instances of great heat experienced in some of the erections he had seen; and I quite agree with him that it is simply outrageous to expect men to work under these conditions, which are altogether unnecessary. In my own case, it will be found that no such trouble exists. The whole arrangement is light, cool, and airy; and work is performed with comfort and ease. As a fact, during last winter we had ice in the cisterns on the floor within 20 feet of the front of the settings. With regard to regenerative work, I am convinced Mr. Terrace, and all who use this system, will get good results. This class of firing has been used by me for the past sixteen years; and the saving in fuel during the period named has been enormous—the money value representing some thousands of pounds. In speaking about the cost of carbonization, it must be borne in mind that wages vary in the different localities mentioned by speakers. Mr. Valon gave as his cost of carbonization 1s. 6½d. per ton of coal with machinery; and I presume the wages he pays are lower than those with which this figure is intended to compare. I would again say that those who speak against the system, do so, not from practical experience, but from observation, and possibly inspection, of those failures which have arisen from want of proper construction. The heating can be done most successfully; the outer arrangements are of a simple kind, and they can be improved, if necessary, while working. Having overcome the first and vital point—viz., the regulation of even temperatures—what remains is very easy to accomplish in order to make the thing almost perfect; and I say that, before we cry down a system because in the hands of one or two it has not worked quite so successfully as could be wished, we ought rather to encourage and assist in its further development. To those who are in doubt, I could say: "Try it, and give us the result of your working." It is open to them to do so; and I am sure the Institute will be pleased at some future time to have these results placed before them.

Mr. J. Emerson Dowson's Paper on Gas Power.

Mr. J. Hepworth (Carlisle) said he wished to thank Mr. Dowson for the information contained in his paper, more especially as he was disappointed at not hearing his former paper at the Institution of Civil Engineers, though he attended a meeting for the purpose when, from some cause, it was postponed. He did not think managers of gas-works generally would resent advice coming to them from any quarter; and some of that contained in the paper, if needed, ought to be carefully considered. But, if he might venture to say so, engineers and managers generally had given a little more attention to their business than Mr. Dowson seemed to be aware of; and they were not quite children in such matters as were brought before them in what might be called the commercial part of the paper. In the first place, Mr. Dowson contended that the cost of gas should be reduced, and that its present price was a hindrance to the use of it for power. They all knew that the cost of the gas-engine had hitherto been a great hindrance to the adoption of gas power; and he (Mr. Hepworth) believed it had been the study of some of them for ten or twenty years how to overcome this difficulty of the primary expense of the engine by reducing the price of gas in every possible way. But, after all, there was a point beyond which it was quite impossible to go; and, whether they had to sell gas or coke, they must, at all events, live and make some profit. It was no use securing a trade if there were no profit attached to it. To some of the statements in the paper, no one could take exception. The more he studied the commercial aspect of the question, the more he was convinced that gas power was the cheapest for the purpose of supplying electricity, when one had to deal with limited areas. In that case gas companies had really done much to diagnose the requirements of their constituents. He could quote several instances where they had obtained Provisional Orders for the supply of electricity; but the demand for it had not arisen. The argument in favour of gas companies taking this supply into their own hands was a forcible one; and, personally, he certainly did think that purveyors of light by gas ought to be purveyors of electricity, if the latter could ever be supplied at a price which would make it possible for most people to use it as a light-giving agent. There were, however, cases where the gas companies had not been able to look upon it as part of their business; and the result would seem to show that they had been wise in their conclusions. Reference had been made to some experience at Morecambe; and, as the Manager of the gas-works in that town was present, perhaps, before the discussion closed, he would favour them with some information on the subject. He (Mr. Hepworth) happened to know the case of another town in the same locality where the owners of the gas-works were unable to see their way to supplying electricity; but another Company did undertake it, and doubtless attempted to make a profitable business of it. The result was that, after three or four years' hard work, the Electric Light Company had been able to declare their first dividend of 2½ per cent.—whether or not it was out of capital or out of revenue he could not say; but the Gas Company, who had doubtless lost some of their lighting, had steadily increased their dividends during the whole time, and were now getting higher rates than they ever had before. He was sure this result would not have been attained if the Gas Company in question had taken the advice given in the paper—viz., that purveyors of gas light should also be purveyors of electricity, with which, to some extent, he agreed. There had been abundant evidence that morning that, where it was convenient, gas companies did use gas-engines; but there were cases where steam was so valuable for other purposes that to shut out a steam-boiler and take in a gas-engine would be folly. Where there was no need for steam for other purposes, no doubt gas power could be employed with economy. He thought gas companies would be able to agree with the author—that gas should be sold at especially low rates for gas-engines, when there was sufficient business to justify this course being adopted.

Mr. W. R. Chester (Nottingham) said Mr. Hepworth had, in a very graceful and gentle manner, drawn attention to one of the features of the paper upon which it was his (Mr. Chester's) intention to make some remarks. The writer had apparently, in the preparation of his paper, forgotten one important matter in connection with his audience—viz., that most of them were men of wide practical experience in the manufacture and distribution of coal gas, and that, if they were anything, they were skilled experts in this particular branch of business. Yet the writer did not hesitate to lecture, to admonish, and to offer gratuitous advice, frequently of the most elementary character, as to the way in which their business ought to be conducted. He laid special emphasis on the old cry of benefiting the manufacturer of one speciality at the expense of users of gas for all other purposes; and he complained that this principle had not been universally adopted by all purveyors of coal gas. No doubt lowering the price of gas to its simple cost to the users of gas-engines would have the effect of stimulating the employment of this speciality, and promote the business of gas-engine makers; but on what

principles of justice or equity could it be done? Take, for instance, a corporation owning the local gas-works. Did the writer consider it possible, in practice, to grant special terms to one trader who might use all his gas in a gas-engine, and make another who consumed all his for cooking purposes—such as a confectioner—pay a higher price? The grocer and the draper who burned gas for lighting their respective shops used it as much for trade purposes as the printer or the carpenter who employed it for driving his machinery; and it was quite impossible to draw a line where special terms could be granted which should be based on equal justice to all consumers, who, if rated, were all part-owners of the undertaking, and therefore entitled to equal consideration. It did not appear to Mr. Dowson that gas engineers could be alive to the desirability of extending their business, nor did he seem to be aware of what was going on in the country to meet the demand for gas coke or residuals for special purposes. If he would apply to Nottingham, or to most other large gas undertakings, he would find that he could obtain coke of any size to suit his special apparatus, and that he could have it in almost unlimited quantities. The recommendations at the end of his paper might be accepted as self-evident; and Mr. Dowson might take it for granted that they had all been under the anxious consideration of gas engineers for the past twenty years, and, where possible, had long been put into active operation.

Mr. W. W. Hutchinson (Barnsley) asked if there was any more tendency to fouling of the cylinder when Dowson gas was used than with ordinary illuminating gas; and whether this was not a serious drawback to its employment. With regard to the sale of coke and preparing it specially for use in a producer, he thought it would be rather a commercial blunder with some to follow the advice given, where they had an excellent sale, at good prices, for household purposes at a much better figure than most persons using Dowson gas-producers were prepared to pay. With respect to electric lighting, he thought many gas companies would be willing to take it up, were it not for the prejudice in the minds of the public that they would be only "nursing" the electric light, and really favouring gas. It would compel them to expend more money than was really necessary, in order to give full satisfaction. Mr. Dowson had pointed out that they had a large reserve of spent heat, which went to waste up the chimney, which might be very profitably employed in this way; but they were prevented from employing it really by the prejudice that existed against gas companies. Certainly, the point had not been lost sight of.

Mr. W. Duff (Morecambe) said Mr. Dowson had stated that, since October last, Dowson gas had been used exclusively for the electric-light engines at Morecambe. This was not quite correct, because the Gas Company had supplied nearly a quarter of a million cubic feet of gas since that date. He was not aware that they had lost one customer through the electric light. In fact, since it had been in use at Morecambe, they had increased their make 15½ per cent.; and during Whit-week, when there were a great many visitors, the increase was 35 per cent. Mr. Dowson referred especially to the west-end of the town, where it was said transformers, &c., were put down to reduce the current pressure to 115 volts. He (Mr. Duff) was surprised that Mr. Dowson should make such a statement, as there was no cable yet laid at or to the west-end, neither was there a house wired. Then Mr. Dowson suggested that it would have been advisable for the Gas Company to undertake the supply of electricity. The Company were quite satisfied with the business they had. They were paying 10 per cent. dividend and were contented to go on with that. Doubtless the Electric Light Company might, during the three months they had been in operation, have declared a dividend of 5 per cent.; but he did not know where it came from. They were now advertising for a great increase of capital.

The President said he coincided with a great deal of what was put forward in the paper, as the views were exactly the same as those he had expressed in his Inaugural Address. He believed it would be well for gas companies to supply the electric light; and, in point of fact, he had referred to this very case of Morecambe, although he did not mention the name. With regard to gas companies not encouraging the use of gas-engines, he could say, on behalf of the Company he represented, that they had done everything they could. In the first place, they had taken 22 per cent. off the price of the gas. It might be said that this was apparently unfair to other large consumers; but the reason for it was that it gave employment to the mains during the daytime, at a period when they would otherwise be practically idle. This enabled them to extend the sale during a larger number of hours. An increase in the consumption during the day would ultimately enable them to reduce the price at night, and so serve those who required light. Besides this, they had adopted this system—that if any respectable man of character and solvency wanted a gas-engine, they let him have one at exactly the price they paid for it. If they had a discount from the maker, they gave him the benefit of it; and allowed him three years in which to pay—charging 5 per cent. for interest and insurance. If a man required a small gas-engine costing £120, they supplied him with the engine; and he paid £10 a quarter for three years. In the first quarter, he paid interest on £120; in the next quarter, on £110; and so on. They therefore certainly did all in their power to encourage the use of gas-engines. He also recommended the Directors to apply for parliamentary powers for supplying electricity; but the Corporation had objected. The reasons given by Mr. Dowson—that in some cases, where an independent electrical company would lose money, it would be quite possible for a gas company to make a profit—were, in the main, the same as those which he had pointed out in his Inaugural Address.

Mr. T. Duxbury (Darwen) said he was rather pleased that it had not gone forth in Mr. Dowson's paper uncontradicted that "gas companies did not encourage the use of gas-engines by reducing the price of gas" as much as possible. He knew that it was done in all parts of the country; but where the capital charges were 1s. 6½d. per 1000 cubic feet of gas sold, as in his case, and they supplied gas for gas-engines at 2s. 6d. per 1000 cubic feet, the consumer had the gas practically at 11⅓d. He thought Mr. Dowson's gas apparatus did not do much towards the reduction of the cost of gas-engines. He knew several instances where people in his own town had prepared estimates for steam-boilers, steam-engines, and chimneys, and found that a gas-engine would cost as much as an engine, boiler, and chimney put together. If gas-engine makers wished to put everything into their own pockets, they could not expect corporations and gas companies to make all the sacrifice. He did not agree with Mr. Hepworth that gas companies should be the purveyors of electric lighting. If this had been done, they would have been "slated" more by electric lighting companies and electricians than they had been already. Do what they pleased, unless the electric light had been made to pay by the gas engineers (when they could not make it pay themselves), they would have laid the blame entirely on the gas engineers. He knew of one town, in which a gas engineer had charge of the electric lighting works, where they supplied a fair quantity of electricity at the very low rate of about 4¼d. per unit. But the Corporation were not satisfied; and, concluding that he might push his gas and not use the same energy to foster electricity, they decided to appoint an electrician in his place.

Mr. Dowson, in reply, said he had been taken to task for venturing to make suggestions to gas managers and engineers of gas-works, who knew more about their business than he did; but it certainly was not in this spirit that he had written the paper. He was requested to do so by the officials of the Institute; and he had complied to the best of his ability. If he had referred to certain points already considered by some of those present, it had been done simply for the purpose of encouraging an interchange of views. Gas companies were interested in the subject of the paper from one point of view, while he was interested in it from another. Naturally, the use of coal gas was rather against his personal interests. But he was anxious to promote the development of gas power generally, quite apart from the use of his own particular plant; and, in view of this, he had ventured to express his opinion. One speaker had said that the questions brought forward had been before the members of the Institute for twenty years or more; but, as a matter of fact, even small gas-engines were then hardly in use, and large ones (to which the paper referred more particularly) had not been in practical work three years. The use of coke gas for driving these engines dated from about the same time; and the production of the electric light by gas power, in a central station, was of still more recent date. He understood that the President

had referred to this branch of the subject in his address; and he was proud to think that he was in agreement with him on certain points. He was not present at the reading of the address; but he should have the greatest pleasure in reading the copy which had just been handed to him. With regard to Morecambe, he derived his information partly from the Engineer, partly from the Secretary of the Electric Company. The equivalent of about 3000 glow lamps of 8-candle power was now used in shops, hotels, and residences; and, rightly or wrongly, he had concluded that these lights had, in most cases, taken the place of gas-lights. As to the extensions to the West-end of the town, he took the precaution to send to the Engineer of the Company a copy of the paper, before it was printed, to ensure the statements as to these extensions being correct; and he could only suppose that there had been some unforeseen delay in completing them. At any rate, he knew definitely that a new engine had been put in at Whitsuntide, in order to supply the distant part of the town, that an addition to the gas plant had also been made for this purpose, that the pipes to receive the cables had been laid, and that the cables were on the ground. Mr. Duff came direct from Morecambe, and he accepted his correction; but although all might not yet be in working order, it certainly would be in a short time. Mr. Duff had stated that, since his (Mr. Dowson's) plant had been used, there had been a consumption of a quarter of a million cubic feet of coal gas. He had not been told of this before; but he thought he could easily explain it. When the new gas-engine was put in, when the addition was made to the Dowson gas plant, and at various other times when changes were made, it had been a convenience to those in charge to use the town gas. This, however, was a temporary expedient; and it did not affect the main aspect of the question, which was that, as soon as all the extensions and additions were in working order, there would be no object in using the town gas. In the course of his paper, he advocated the reduction in the price of gas supplied for engines; and one or two gentlemen had retorted that the price of the engines should be reduced first. As a matter of fact, during the last two years the prices of gas-engines had been brought down very considerably. The "Otto" patent expired about two years ago; and 10 per cent. on the price of the engines was at once taken off—this being the amount of royalty paid during the continuance of the patent. About the same time, several important makers had come into the field. The effect of competition had been to further reduce the prices; and they were now something like on a par with those of steam-engines. A few days previously he saw the report of the gas engineer to a corporation concerning the lighting of a portion of the town with electricity; and in this there was a careful, comparative estimate of the capital outlay and working cost of steam-power plant and gas-power plant. According to this, the capital outlay was almost identical, while the working cost was in favour of gas power. Replying to the question put to him, it was true, to a certain extent, that the cylinder and valves of an engine were slightly more fouled with Dowson gas than with ordinary coal gas. With the latter, the valves were usually cleaned once a month, or every five or six weeks. With Dowson gas, the general rule was to clean them once a week; and this was the only practical inconvenience. It was very difficult to thoroughly clean a large volume of gas taken straight away from the producer to the engine; and if refinements of purifying were adopted, large and costly plant would be necessary.

The PRESIDENT asked if there was any danger of coke dust getting into the engine.

Mr. DOWSON said there was never any grit carried forward. What really happened was this: The generator was worked with a strong steam pressure at the injector; consequently, the velocity at which the gas left the regenerator was high, and it carried with it the light particles of ash. In order to catch these, the gas was passed first of all through water, then through coke, and finally through sawdust, before it entered the holder. These precautions practically stopped all the gritty matter; but when coke was used, from which all the hydrocarbons had not been extracted in the retorts, a certain amount of tarry vapour was formed in the generator, and travelled through the coolers and scrubbers as a sort of fog. Some of this vapour reached the engine, and in certain cases a fine impalpable powder also; and the oil on the engine made it stick. This was the cause of the deposit, which was tarry, not gritty. His remarks about the possibility of gas companies supplying coke suitable for generator gas had reference more particularly to the use of coke instead of anthracite. At present, the making of the generator gas was limited to two kinds of fuel—anthracite and coke. In some districts, anthracite cost 24s. to 25s. per ton; and his contention was that in many places clean small coke could be sold, at a good profit, at a lower rate than was paid for anthracite.

Mr. CHESTER remarked that Mr. Dowson could get broken coke, the exact size he wanted, from any of the London Gas Companies.

Mr. DOWSON said he was aware that this was so in certain places; but he would instance Chelsea as an example of what he referred to. Dowson plant for about 150-horse power was put in at a flour-mill; and, as it was close to the gas-works, the owner of the mill thought of using coke instead of anthracite at about 23s. a ton. He had tried it, but found there was no saving; and so he gave it up, and had reverted to anthracite. He could give several other instances, if necessary.

Mr. Alfred Bevis has been appointed Accountant to The Gaslight and Coke Company, in place of Mr. John W. Field, now the Secretary and General Manager.

Death of Mr. R. S. Foreman.—We regret to announce the death of Mr. Robert Stannard Foreman, which took place suddenly, at Bognor, on the 2nd inst. The deceased gentleman was a Director of the Singapore Gas Company, Limited, from the formation of the Company, and succeeded the late Mr. H. P. Stephenson in the chair in 1881; continuing to hold this position till his death. Mr. Foreman was in his 69th year. The funeral took place at Nunhead, and was attended by the Directors of the Company.

Proposed Memorial to the Late Mr. Henry Gill.—We learn that a movement is now on foot in Germany to erect a bronze bust (larger than life size) of the late Mr. Henry Gill, at the new Berlin Water-Works at Mueggel-See, which are being constructed from his designs. It was his great wish that he should see the completion of these works—a wish which, unfortunately, was not granted to him. An appeal is made to his friends and professional brethren to contribute to this fund, so that it may be possible to erect a monument worthy of him. The banking firm of Delbrueck, Leo, and Co., Mauerstrasse, 61-62, Berlin, have undertaken to receive contributions.

The Incorporated Association of Municipal and County Engineers.—The annual meeting of this Association is to be held at West Bromwich during the last three days of the present week. Among the papers to be read are the following: "Notes on Hydraulic Formulæ," by Mr. W. Santo Crimp; "Mains for Electrical Distribution," by Mr. C. H. W. Biggs; "Municipal Electricity Works," by Mr. R. Hammond; and "Sewage Difficulties at Nuneaton," by Mr. J. S. Pickering. The programme includes several excursions to works in the district; while the Mayor and Corporation of West Bromwich will entertain the members to luncheon, and the Mayor of Birmingham will give a garden party.

A Study of Light-Sources by Photography.—In a recent issue of *Nature*, reference was made to the photographic study of sources of light by means of a carefully graduated series of exposures, which was first applied with great success by M. Janssen to the investigation of the minute structure of the solar surface. M. Crova has now applied a similar method to the study of the Carcel standard and the electric arc. A contrast between the various parts of the magnified photographic image of the Carcel flame does not appear until the exposure is reduced to the minimum necessary to secure an impression; and to bring out this contrast, the negative must be developed slowly and subsequently intensified. Four photographs thus obtained were exhibited at a recent meeting of the French Academy. The axis of the flame appears dark, and the zone of combustion exhibits two bright lines representing the external and internal surfaces of combustion of the hydrocarbons, with a dark line between them corresponding to the space where combustion is incomplete. Photographs of the flames of a candle, an amyl-acetate lamp, and a batswing gas-jet were also exhibited, showing analogous phenomena. The same method applied to the arc light yielded some very interesting results. As the time of exposure was reduced, the arc gradually vanished; the negative carbon was reduced to a very small surface; and the positive carbon exhibited a surface riddled with dark spots, and granulated like the surface of the sun in M. Janssen's photographs. These granulations could be seen in violent motion on the ground-glass screen of a camera with the lens sufficiently stopped down. It follows that it is not admissible to screen off all but a very small portion of the luminous source, in order to reduce the amount of light in the same proportion as the area of luminous surface. With very small surface elements, both the amount of light and the temperature, and hence also the tint of the light, may be constantly changing.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 97.)

THE record of business done on the Stock Exchange during the past week might almost be a paraphrase on the celebrated chapter on "The Snakes of Ireland"—"There are none." A more dislocated week has rarely, if ever, been known. The Royal Wedding in the middle of it, with all the excitement and crowding to view the decorations on the preceding and succeeding days, was quite sufficient to throw general proceedings into disorder; but added to this were the attractions of Henley and Lord's, the tropical heat of the weather, and "Independence Holiday" in the States, which closed one of the busiest markets. Thus business, which was not disposed to be active even had all these deterring influences been absent, was reduced to the most meagre proportions. Where prices have moved at all, they are lower for the most part; but changes, altogether, are few and slight. More favourable light is apparent in some directions, owing to the recovery in silver; but whether this is maintained, depends upon some factors which cannot yet be known. The Money Market seems to be in a position of assured ease; the supply being considerably more than adequate to meet any probable demand. The Gas Market has fully participated in the general stagnation; but, though business has been so quiet, there is not much to be detected by way of a falling off in values. Indeed, Gas stocks all round, as a class, are in excellent favour; and this is no more than should be expected, if people will only calmly and dispassionately appraise their true position and strength. There is only one retrograde movement in the quotations; but, although changes in the other direction are not more numerous, prices realized show the general firmness. In Gaslights, what few transactions were effected in the "A" stock, showed a level of about 227. The quotation was put down 1 on Tuesday, but was promptly reinstated the next day. The secured issues—debenture, preference, and limited—were comparatively more brisk; and the "G," after a long period of quiescence, moved up a few points. In South Metropolitans, nothing was touched but "B," which changed hands to a moderate extent at the same as recent figures. Commercials were firm and unchanged. The Suburban and Provincial list opened with a great show of activity in British, but soon relapsed into perfect stagnation. Among the Continentals, Imperial was more freely dealt in, and gave early signs of weakness—the quotation falling a couple of points. None of the rest exhibited any noteworthy feature. A few transactions were marked in the Water Companies; but no change occurred in any of the quotations.

The daily operations may be briefly summarized as follows: Monday's business was extremely quiet, and quotations did not move. Tuesday was brisker, especially for Gaslight secured issues. Imperial Continental fell 2; and Gaslight "A," 1. Wednesday was much the same as the previous day. Gaslight "A" rose 1; ditto "G," 5. On Thursday, the Stock Exchange was closed. Friday reopened with quiet business in the chief issues at unchanged figures. Saturday was even quieter than usual—business being again interrupted by Royal festivities in the City; and all quotations closed without variation.

ELECTRIC LIGHTING MEMORANDA.

Electric Light for Illuminations—Ineffective Electrical Decorations—The Nature of Electrical Investments—The Manchester Corporation Electric Light Department.

THE illuminations for the Royal wedding on Thursday last furnished a good opportunity for showing the public the extent to which electric lighting lends itself to festal uses of the kind. It is very many years since London was illuminated to anything like the same degree. A tremendous trade has lately been done in gas devices; and the result was a spectacle of ordered effulgence that gave pleasure to countless thousands of sightseers. The account of the illuminations given by *The Times* speaks of whole streets bathed in a flood of light, the effect of which was enhanced by pleasing combinations of colour and design. From the published accounts, it may be gathered that while the majority of prominent public and private buildings in the main streets given up to this kind of adornment adhered to the gas lighting which has served so well in this capacity ever since the Peace of Amiens, the electricians were by no means idle. Arc lamps were exhibited in several instances; but these are too unmanageably bright to blend effectively in any scheme of decoration worthy of the name. Much more pleasing use can be made of incandescent electric lamps; and this was proved in many cases, chiefly, of course, of premises devoted to some branch of the electrical industry. The serious expense of adapting incandescent lamps to illumination of the architectural variety, which is the most effective of all, prevented even the dealers in these articles from going far beyond the conventional stars and "set-pieces," which can be produced just as well by means of the humble Vauxhall lamp.

While mentioning last Thursday's illuminations, it may be remarked that the gift of graceful arrangement of show-pieces intended for setting off incandescent lamps seems to have been denied to the American electricians, as was certainly the case with their English colleagues on the occasion of the Crystal Palace Electrical Exhibition. Everybody who attended that show shuddered at the awful example of the screen of incandescent lamps set up in the nave of the Palace by the Edison and Swan people, with its really puerile imitation (?) of sky-rockets. This abomination was understood to cost much money; and it was the eyesore of the show. Now at Chicago there is a display including just such another monstrosity, called by the newspapers the "Tower of Lightning." This is a column studded with a large number of incandescent lamps—red, white, and blue. "From the top four lines of lamps containing the three colours branch out in different directions, each having a forked course like a streak of lightning." It is one of the intellectual treats of the Exhibition to watch these lamps lighted up; and many visitors stand staring at it, until they go away, as we are told, "feeling content with themselves that they have for once comprehended the manner in which electricity is controlled." No wonder the Chicago Exhibition is such a doubtful success, if this is a fair sample of the kind of combined instruction and entertainment provided.

A correspondent of the *Financial News*, writing upon the subject of electrical investments, remarks upon "the well-known fact that electrical undertakings in this country have from the outset been used as the medium of financial speculations as disastrous to the investor as they proved fatal to the progress of applied electricity." It is sometimes argued that, while this is undoubtedly true, the statement applies to a condition of things that existed ten years ago, and that the electrical industry is now firmly established upon the high road of commercial success. This writer shows, by reference to the circumstances of the Electric Construction Corporation and the Electric and General Investment Company, that "the old curse still clings to electric undertakings," and that "the money invested in them still finds its way into the promoter's pocket, and is wasted by foolish management." After hardly more than three years' working, the Electric Construction Corporation are compelled to submit to their shareholders a scheme of reconstruction involving a loss of £360,000 to the ordinary shareholder; while the Electric and General Investment Company, on the other hand, at their recent annual general meeting, declared a dividend after the rate of 30 per cent. per annum upon their ordinary shares. It is observed that it is quite time somebody spoke out, to point out to the investing public the simple truth that the enormous dividend in question came out of the pockets of the shareholders of the Electric Lighting Corporation, the Brush Company, the City of London Electric Lighting Company, and the New Telephone Company (now defunct), all of which concerns were either bought out by, or raised fresh capital through, the agency of the Electric and General Investment Company. As the writer—Mr. Julius Maier—pertinently says, genuine and sound undertakings ought not to require any such financial manipulation; and it is these speculative operations which have stood in the way of electrical progress in this country. How far electric lighting as a statutory business is to go in earning profits large enough to pay dividends on these inflated capitals, is a question that the future will answer; but not, we venture to think, in a sense pleasing to the shareholders.

We have been furnished by Mr. Charles Nickson, the Superintendent, with a copy of the accounts of the Manchester Corporation Electric Light Department for the past year. The buildings of the generating station in Dickinson Street are now completed, and most of the plant is in position. The distribution works are in an advanced stage; and it is anticipated that current will be ready for the consumers by the 1st prox. It is to be hoped that this expectation will not be falsified by the event. It appears that of the total authorized loan of £80,000, only £50,200 has yet been borrowed, of which £41,720 has actually been spent. But there will be nothing left to the credit of capital account by the time the works in hand are completed. We hope to follow these Manchester Corporation electric lighting reports and annual accounts as they come to hand; for it is due to the department—which is merely the Gas Department in little—to say that they are not accustomed to confuse or suppress matters in their accounts. The case of a municipal electric lighting venture, whether in Manchester or elsewhere, remains as it was put by Mr. Garcke, of the Brush Company, with reference to an undertaking of the kind the contract for which was *not* placed with this Company—there is no single account in which all the expenses chargeable to the undertaking can be found for comparison with company working. This, however, must be allowed for when the circumstances of the venture are in question. In this Manchester instance, although Mr. Charles Nickson signs the report and accounts, and they emanate from the Gas Department offices, no clerical or administration expenses are charged; and the only item that appears to represent the cost of management in connection with the outlay of this £41,720 of capital is £485 for engineer's advice. This is where these municipal electric lighting schemes have the apparent advantage of company working; for with the latter a heavy proportion of the initial outlay is unremunerative. How much does it cost an average central station electric lighting company for establishment and other non-effective expenses, for every £40,000 of capital expenditure? The question may be asked; but it is not likely to be answered, while capital accounts remain open on every side.

GAS-ENGINES PRESENT AND FUTURE.

The recent meeting of the Royal Agricultural Society, at Chester, was made the occasion of a striking demonstration of the advance of the gas-engine as a motor of general application. There is not at the first sight much connection between the gas-engine trade and an Agricultural Society. But facts in this, as in so many other British institutions, go beyond nomenclature; and the implement exhibits at the Royal Agricultural Society's shows have always been comprehensive enough to embrace specimens of every kind of motor. Indeed, when the Society, many years ago, set about the task, long since fulfilled, of improving the portable type of steam-engine, it constituted itself the patron of all who engage in the design and manufacture of small motors for land use. And the annual shows have served to indicate the lines of development of this branch of mechanical engineering, so that whoever wanted to know what was being done in the way of small portable or semi-portable engine building has been able to improve himself by attending these peripatetic exhibitions, or studying the descriptions thereof published by the engineering journals. Practically, this order of exhibitions are far more useful to the trade and the public than big shows at irregular intervals.

With regard to the Chester meeting, it is deserving of notice that an engineering contemporary has put it upon record that "steam-engines now take a subsidiary place in the interest of the show." This is the sign of the times to which we desire to call our readers' attention. The steam-engine trade is still, of course, in the ascendant; and the engines themselves are being turned out by the established makers in a style never before approached. The rough-and-ready class of small steam-engines that once appealed to buyers whose need of strength and serviceability in their tools was supposed to condone clumsiness of design and lack of finish in construction, have gone out of fashion. As the same contemporary remarks, there is nothing for an engineering critic to talk about in modern steam-engine building, which is a steadily profitable trade for those engaged in it, provided they have commercial ability and ample capital to provide the necessary tools for reducing manufacturing cost to a minimum. This means the extinction of the small maker, and the concentration of the trade in the hands of a few great factory-owners. But it also means highly-finished and comparatively low-priced steam-engines, which is a gain to the community. All the same, the number of mechanical engineering firms who take an interest in gas-engine making is on the increase; and the same may be said of the number of power users who ask whether steam or gas is capable of furnishing the cheaper power.

The gas-engine of the period may be driven by coal gas, by combustible producer gas, or by gas generated on the spot from petroleum, in which case it is called an oil-engine, though the title is not strictly correct. Some little time ago, efforts were made to develop motors using highly-volatile petroleum spirits; but these do not appear to have established themselves in public favour, presumably for lack of any distinct advantage to compensate for the trouble and risk attending the handling of naphtha in large quantities. The size of gas-engines is growing larger; and we are able to supplement the information recently published in our columns respecting the working of a 100-horse power gas-engine in Belfast, by the intelligence that a firm of builders of these motors are making a four-cylinder gas-engine of 400-horse power nominal for a flour-mill in the South of England. This brings the competition between steam and gas power into a very acute stage; for there are few purposes to which power is applied on land that require motors of larger size.

It is remarked that gas-engines are "already settled down into a fixed pattern. The 'Otto' cycle has very nearly driven all the rest out of the field; and of the numerous patents that were taken out with a view of avoiding its use, but very few have any commercial value now. In spite of its most serious defect, of providing only one effective stroke in four, it still holds the field against competitors of more lavish promise." This statement is correct in the main; but its truth is no compliment to the engineering of the period, since it is only a way of saying that art has stood still for some fifteen or sixteen years in the matter of getting motive power out of gas through the agency of an internal combustion engine. Multiplying the cylinders of an "Otto" cycle engine, and increasing the weight of the fly-wheel, are the favourite devices for improving the regularity of its action; but they only illustrate the failing that calls them into existence. The "three-to-one" cycle has never commanded the admiration of engineers; and it is a reflection upon their skill that they should be found guilty of taking advantage of the lapse of the master patent to scramble for the crumbs of Messrs. Crossley's immense business.

The popularity of gas-engines of large size will be prejudiced by their heat, and one or two other drawbacks of the existing type of internal-combustion motor. A 100-horse power engine is not a comfortable thing to have shut up in a confined space; and a 400-horse power engine will put a severe strain upon the skill of a ventilating engineer, if installed anywhere else than in an open shed. Moreover, the necessity for keeping the motor cylinder cool by circulating water is a saddening one for the physicist who knows that this means wasting 40 per cent. of the energy of the fuel. It is truly astonishing that modern engineers should be content to copy and multiply designs vitiated by this obvious shortcoming; but so it is. The wit of man seems incapable of passing the bounds confessed by the genius of Otto in regard to the generating of power by the direct burning of gas. He stopped when he had succeeded in solving the preliminary problem of obtaining power from gas at a price that made the motor marketable; but one is loth to believe that everybody else must halt in the same place.

In the course of some observations addressed to the members of The Gas Institute during the recent Belfast meeting, Mr. Denny Lane lifted a corner of the veil that has hitherto shrouded the future of the gas-engine from view. He spoke of the two principles upon which motor engines can be built, according to whether the pressure or the force of impact of the working fluid is to be used in driving the moving parts. In the first class of motors, tight sliding surfaces, to prevent leakage of the working fluid, are necessary, which limits the range of temperatures between which such engines can be worked. In this class, all the gas-engines, and nearly all the steam-engines, at present in the market are embraced. There are, however, steam-engines which work by impact, like turbines, to which the necessity for preserving tight sliding surfaces does not apply. The most perfect example of an impact motor is the Pelton water-wheel, which is driven by water delivered in a jet under a great head, and has been found to develop a very high duty. Impact motors have their weaknesses, however, like the others, albeit the influences that make for inefficiency in their case are of a different kind to the drawbacks of the pressure motors, and relate mainly to incompatibility between the rate of motion of the working fluid and that of the moving parts of the machine. With water for the working fluid, moreover, considerations of expansion do not arise, as in the case of an expansive fluid like steam or the products of combustion. If we could get both the impact and the expansive force of ignited gas and air to act upon the vanes of a sort of Pelton wheel, and if we could make use of the revolutions of such a wheel after the rate at which the working fluid could be set in motion, the result would be a gas-engine that would at once beat the existing types out of the field for economy.

This is the direction in which it is conceivable that a gas-engine without refrigeration may be sought. There is no secret about the theory, any more than there is about the practical advantages of a hot-working gas-engine. But the world is no nearer to a realization of this *desideratum* than when the late Sir W. Siemens lavished his time and his money upon the problem. It is an example of the failure of demand to create supply, when the product is that of the brain. Wealth "beyond the dreams of avarice," to say nothing of fame and distinction, await the inventor who shall deliver the gas-engine from the wastefulness of the circulating water jacket, and shall reduce the fly-wheel to its proper function. Hitherto these inducements have been held out in vain; and the gas-engine has remained nothing more than a masterly makeshift. Once let gas, whether retorted from coal or produced with air and steam in a generator, yield all its energy in doing work, and not spend nearly one-half of it in deferring to the inexorable requirements of a reciprocating engine movement, and the days of the small steam-engine would be numbered. As it is, the economy is on the side of the gas-engine, where other conditions render the two motors strictly comparable on their merits. But this fact should not blind us to the truth that the gas-engine is as yet far from being perfect even as the steam-engine is perfect.

Value of Water-Meters.—The value of meters in preventing the waste of water is shown in a recent report by Mr. G. Hillyer, the President of the Atlanta Water-Works. In March, 1885, the city contracted for a supply of coal for the succeeding year; the quantity being estimated from the amount burned during the preceding twelve months. The city was then pumping 6,000,000 gallons of water a day, and nobody had enough. A number of serious fires broke out, at which the firemen were seriously hampered by lack of water. Consequently, as a matter of absolute necessity, meters were put on. The consumption at once fell off to 1,500,000 gallons, and everybody had sufficient. Moreover, the coal bought in March, 1885, lasted through the remainder of the year, all 1886, and until July, 1887. In 1885, before the meters were applied, and while there were only 1500 services, the consumption of water was 6,000,000 gallons daily. Now, with 4533 services, all metered, the consumption is only 2,530,000 gallons a day; or only about three-sevenths as much. The Superintendent (Mr. W. G. Richards) states that the meters are the property of the landlord; the city keeping them in repair so far as the labour is concerned—the new material being charged to the owner. The Water Department commenced this system of repairs in November, 1892; and in the first six months, they repaired 265 and condemned 26 meters. Mr. Richards believes that the principal cause of meters getting out of order is that they are often too small for their duty; the ⅝-inch meter being the size generally put in to measure the average domestic supply. The proportion of larger meters that get out of order in Atlanta is very small.

NOTES.

Standardizing the Hefner Light.

An official report has been issued from the German State Physical and Technical Institute, at Charlottenburg, signed by Professor von Helmholtz, relating to the arrangements now adapted by the Institute for testing and standardizing the Hefner-Alteneck unit of light. The report rehearses the fact that in 1884 Herr von Hefner-Alteneck brought out his proposed standard of light for photometrical purposes, which is described as follows: The unit of light shall be a free-burning flame, in still, pure air, supplied by a section of solid wick, and fed with amyl acetate; the wick-tube to be circular and of german silver, measuring 8 millimetres internal, and 8·3 millimetres external diameter, and 25 millimetres high; and the flame to be 40 millimetres high, measured from the edge of the wick-tube, at least ten minutes after lighting the lamp. It is also put upon record that the ratio between the normal German paraffin standard candle, with a flame of 45 millimetres, and the Hefner light is $\frac{\text{German candle}}{\text{Hefner light}} = 1{\cdot}2$; and, in the same way, the ratio of the English standard candle, with the same length of flame, is $\frac{\text{English candle}}{\text{Hefner light}} = 1{\cdot}14$. A variation of 0·02 in the light-measurement is permitted. The full fee for standardizing a lamp is fixed at 5·50 marks.

Rubble Concrete.

It is stated in *Engineering* that the method of "rubble concrete" construction—which we may remark was adopted by the South Metropolitan Gas Company for the latest gasholder tank made at their East Greenwich station—has been extensively employed by Mr. John Strain, the Engineer of the new Callander and Oban Railway, for a number of lines in Scotland and also in Spain. This term is used to designate a mixture of large stones embedded in a matrix of Portland cement concrete. The method of construction involves close attention to details. The cement must be carefully specified and tested, to ensure its being of the best quality. It should be stored upon the works at least one month before being used, and placed under cover in perfectly dry sheds. During the fortnight prior to its use, it is spread out on a wooden floor raised 2 feet above the ground, and turned over every alternate day for the fortnight, or until it is sufficiency cooled and fit for use. Mr. Strain specified the following conditions for his cement: The residue on a sieve of 2500 meshes per square inch was not to exceed 20 per cent.; the weight per cubic foot to be not less than 90 lbs.; test briquettes gauged neat to stand a tensile strain of 790 lbs. after seven days—the last six being in water. After the cement was sufficiently aired, it was refilled into bags, which had a content bearing a direct ratio to the size of the gauge-boxes used for mixing with the ballast. The sand was always clean and sharp, gauged 5 to 1; and the mixture was turned over four times dry and four times while being wetted by a rose. The concrete was laid in beds 6 inches thick; and on it rubble blocks were laid—care being taken to keep the blocks 3 inches apart, and the same distance from any exposed force. The blocks were then covered by another 6 inches of concrete, and so on. In a Scotch railway, blocks up to 2 tons weight were worked in in this way. A fine example is a skew bridge over the River Dochart on the Killin Railway.

Sulphur for Holding-Down Bolts.

Mr. E. F. Miner has reported to the Washburn Mechanical Engineering Society upon some experiments conducted for the purpose of ascertaining the best way of making fast holding-down bolts in stone. The experiments were carried out with a Fairbanks testing machine; and the materials tried were Babbit metal, lead, and sulphur, all melted and poured round the bolts, which were set to a depth of 6 inches in holes sunk in prepared cubes of hard granite. The holes in the stones were as nearly as possible 2 inches in diameter; and the bolts were 1¾ inches in diameter. The loads were applied slowly, and measurements for extension made at each 500 lbs. increment. At every additional 5000 lbs. the load was allowed to remain steadily on for five minutes. Both with lead and Babbit metal, there was a very perceptible movement of the bolts under a slight load, or until the metal and stone had come to a fair bearing. With sulphur there was no measurable movement either of bolt or setting up to a strain of 20,000 lbs.; and the experiment ended with the giving way of the iron straps holding the stove. In no case was the bolt drawn; and the experiments were held to have demonstrated the superiority of sulphur setting in every possible way.

Benzene Vapour as a Motive Power.

The possibility of employing benzene or the light oil from the distillation of petroleum in place of steam as a motive power has been discussed by M. Meiro in a recent volume of the records of the Imperial Russian Technical Society. He has ascertained the amount of vapour produced in unit time under known conditions of pressure, and also the vapour tensin of benzene at various temperatures. Trial was made of the vapour in a condensing steam-engine; the condensed benzene being returned to the boiler. Benzene of ·724 sp. gr. was vaporized in a small boiler under a pressure of nearly two atmospheres, at the rate of 1·9 kilogrammes per square centimetre of heating surface. The results were constant with benzene of the same specific gravity and boiling-point; small variations in physical qualities having no influence at a moderately high temperature. The specific heat of benzene is much lower than that of water; consequently, heating power is saved. No greater danger may be expected from the use of benzene than from the employment of water in boilers, as furring and corrosion cannot take place. A small quantity only of benzene would be required for feeding purposes, as the loss by imperfect condensation need be but slight.

The English Equivalent of the Carcel.—According to a note to a sentence in an article descriptive of the reconstructed lighthouse at Cape La Hève, which appears in the current number of *Engineering*, the exact equivalent of the light given by a Carcel burner has been ascertained, by some recent photometric measurements at the French Lighthouse Department, to be 10 standard candles, as against the hitherto variably estimated value of 9·2, 9·5, and 9·8 candles.

Messrs. Frankland and Ward on the Bacteriology of Water.—We have been favoured by Professor Percy Frankland with a copy of the second report presented to the Water Research Committee of the Royal Society on the investigations which he has been conducting, in conjunction with Dr. Marshall Ward, into the bacteriology of water. It may be remembered that, in their first report, already noticed in the JOURNAL, the authors endeavoured to give a concise account of the more important work which has been done on this matter, and devoted special attention to those investigations which have thrown light on the vitality of pathogenic bacteria when submerged in aqueous media of various kinds and under different circumstances. In their present report, they deal with the vitality and virulence of the *bacillus anthracis* and its spores in potable waters. These researches are much too valuable to be dismissed in the few lines now devoted to the report in which they are embodied, and further attention will be given to them in a subsequent issue.

Safety Cages in Mines.—Accidents resulting from the breaking of the ropes by which cages are raised and lowered in collieries are usually attended by such terrible consequences, that any appliance devised for preventing or minimizing them deserves notice. We are therefore pleased to direct attention to an invention of remarkable simplicity, but apparently perfectly safe in its operation, which has been submitted to those interested by Mr. T. Settle, Manager of the New Mill Gas-Works, near Huddersfield. In their ascent and descent, cages are kept in position by an attachment on each side to steel rods, running the length of the shaft, up and down which slide circular pieces of iron, fastened to the cage. The apparatus consists of a couple of clips, which embrace the steel rods. When the cage is in motion, the tension of the rope, caused by the weight of the cage, keeps the clips open; and the working of the hoist is not interfered with in the slightest degree. Should the rope break, however, and the tension thus cease, the clips are liberated, and, fastening themselves firmly to the rods, instantaneously bring the cage to a standstill, in whatever part of the shaft it is. The utility of the invention is obvious. One of the appliances was recently subjected to a practical test; and the result was in every sense satisfactory.

The Great Falls Submerged Main.—In a recent number of the *Engineering Record*, some particulars are given of the submerged main supplying water to West Great Falls, the portion of Great Falls (Mont.) lying on the west bank of the Missouri River. It consists of 10-inch (70-lb.) cast-iron pipe; and it crosses the river about 50 feet below a steel waggon bridge, where the water is from 18 to 42 feet deep, and very swift. The pipe was laid in a trench 2 feet deep, blasted through solid rock all the way across the river. The pipe was kept laid up to within 40 or 50 feet of the blasting crew all the time, and protected from the force of the current by a rough coffer-dam built from one pier to another, and then removed to a position between the next two piers as fast as the work progressed. In laying the main, a flexible joint was used every eight lengths, or 96 feet so that the end of the pipe was always out of water. As fast as the pipe was laid, or a joint was caulked, the section was lowered enough to bring the end of the pipe just above the water, so that the next one could be caulked on to it. The pipe was lowered by slinging it from a set of screw-rods passing through frames fixed in the bed of the river about 12 feet apart. These rods were slowly lowered until the pipe was in its proper position, where it was bedded with finely-broken rock and gravel. To make sure that the joints were perfectly tight, a plate was bolted over the end of the main after a few lengths had been laid, and the main filled through a small pipe connected around the gate valve on the shore. After the whole job was completed, the main was filled, and the gate-valves on each side of the river were closed. A pressure of 150 lbs. was then applied through the small pipe, which was afterward shut off. In two hours' time, the pressure on the gauge did not fall more than 10 lbs.; and when a very slight quantity of water was admitted through the small pipe, the pressure instantly rose to 150 lbs. again. The pipe has been tested twice since, and been found perfectly tight. The tota length of the submerged main is 950 feet.

CONSTANT DISTRICT PRESSURE AUTOMATICALLY MAINTAINED.

In the JOURNAL for May 16 last (p. 886), we published an article, under the above heading, in which Mr. W. Cowan, of Edinburgh, described his latest inventions for the automatic maintenance of pressure over a district. It was then mentioned that a further development of the ideas embodied in the appliances there illustrated, forming the subject of a separate specification, would be dealt with in a subsequent communication. This Mr. Cowan has now supplied.

In the former article, it was shown how the pressure in a district remote from the governor which supplies it may be automatically maintained against all variations in the demand from whatever cause arising. The degree of the pressure so maintained was proved to depend on the weighting of the auxiliary gasholder, the amount and the arrangement of which were determined by the degree of the pressure required. It followed from this that the "constant district pressure" was susceptible of alteration, when necessary, by merely rearranging or varying the respective amounts of the weights suspended over the auxiliary gasholder bell. In like manner, the particular locality of the constant pressure might be changed by removing to some other part of the district the junction of the pressure-pipe with the main. As in the original selection of the point of junction, so also in any alteration thereof, the worst supplied of the more distant localities should be considered, because one or other of these would generally be found the most suitable position for the connection. The maintenance of a moderate, but sufficient, working pressure in such a locality is as necessary and desirable for the consumers there as it is for those in other parts of the district. To ensure to consumers in a remote locality the supply they need, and to have this done automatically in the manner proposed in the present invention, would not only secure that object, but would also be the most effective means of meeting the necessities of the whole district.

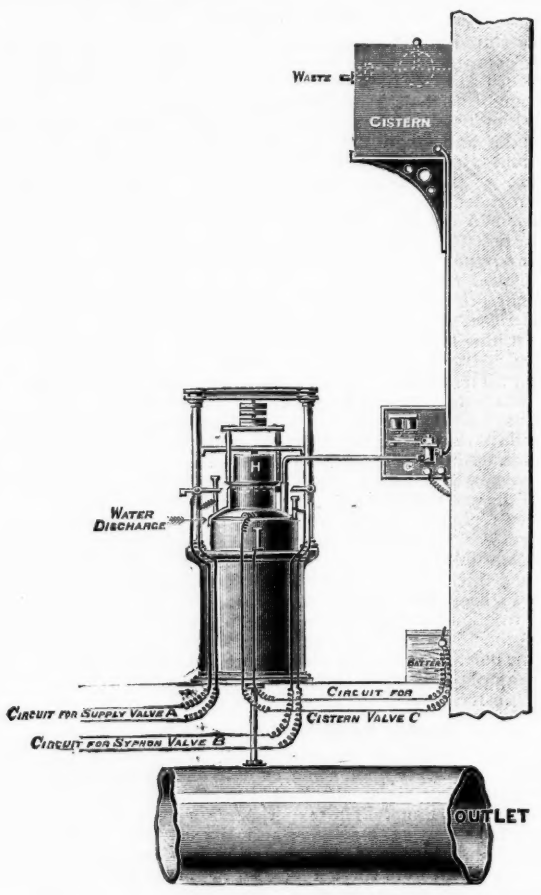
It must be remembered that, in loading and unloading gas governors, the object is not so much to increase or to diminish the pressure to *consumers*, as to keep up in the mains a full supply to meet their requirements. For example, the pressures which issue from the outlet of the governor have no necessary relation to, or correspondence with, the pressure that is best adapted for advantageous consumption. The pressures proceeding from the governor outlet are those which a varying demand on necessarily more or less inadequate mains renders imperative, in order to maintain a full supply all over the district. This will be best illustrated by considering what would be the result in a district of uniform level, to supply which the governor was loaded and unloaded by any of the usual methods.

In such a district, and with mains of no more than the usual average carrying capacity, the consumers near to the governor would be supplied at a higher pressure than those at a distance from it. This would, of course, be practically inevitable. But, apart from this, there would seem to be no reason, as there could be no desire, for supplying the former group of consumers at a greater degree of pressure than that which would suffice for the latter. In the case supposed, the excess of pressure in the neighbourhood of the governor would not be necessary, *for the consumers* in that locality, but would be required only for the purpose of preventing a reduction of pressure in remote districts, when the demand in nearer districts was largely increased. In fact, the object in regulating the governor load would be to provide a sufficient pressure, at all times, in the most distant localities, while not increasing unduly the pressure in nearer localities. It is not too much to say that, in a level district, the best results would be obtained by so regulating the load that the remote district pressure would vary but little, if at all, through all the changes of pressure at the governor outlet There would probably be one or more points in the remotest parts of the district, where a constant, or practically constant, pressure would be the result of all the variations made in the governor load. In such circumstances, a steady pressure in the remote district might safely be made the primary object of the loading, for this would ensure an adequate supply to the whole district served by the governor.

Although a perfectly level district is a scarcely conceivable supposition, it may yet serve a useful purpose as an illustration to indicate what would probably be the most suitable point, in the main of a remote district, at which to connect the pressure-pipe of the auxiliary gasholder, employed under the new system to regulate the loading of the governors. Difference of level in a locality will probably not affect the general truth of the assumption that, even in districts possessing numerous and varying elevations, there will be points where the pressure is little affected by the variations produced at the governor outlet by changes of load. Such a point would be the most suitable for the junction of the pressure-pipe with the main; and this would be especially the case in the event of the pressure there being relatively low. For example, the most desirable position for the pressure-pipe junction would not always, or in every instance, be at the end, or even at any part, of the trunk main; for, in some cases, possibly it would be better to connect the pipe to one or other of the branches or services which the main supplies. With such a system in operation, it will be evident, that the maintenance of a constant pressure in a remote part of the district supplied by a governor would necessarily imply that the demands of the rest of the district must be adequately provided for. The former includes the latter, and is the result, as well as the condition, of its accomplishment.

The auxiliary gasholder is, however, not restricted, as the invention is not limited, to the production and maintenance of only one pressure, even though, as has been explained, that pressure may be of any required degree. Provision has also been made for automatically increasing, or even for decreasing, the normal or constant pressure when necessary. The instances in which this "further development" may seem to be indispensable for the successful application of the system will probably be few in number. But the fact that the invention provides for automatically varying, as well as for maintaining, the district pressure, may tend to overcome an initial objection to the system.

The means employed for effecting the above object are, generally, as follows: A loading-tank is added to the roof of the auxiliary gasholder bell, and to this tank water is supplied when any undue fall of the pressure, and consequently of the bell, takes place. The load of water then added prevents the bell from rising (and, therefore, keeps the valve which supplies water to the governor loading-tank from closing), till the

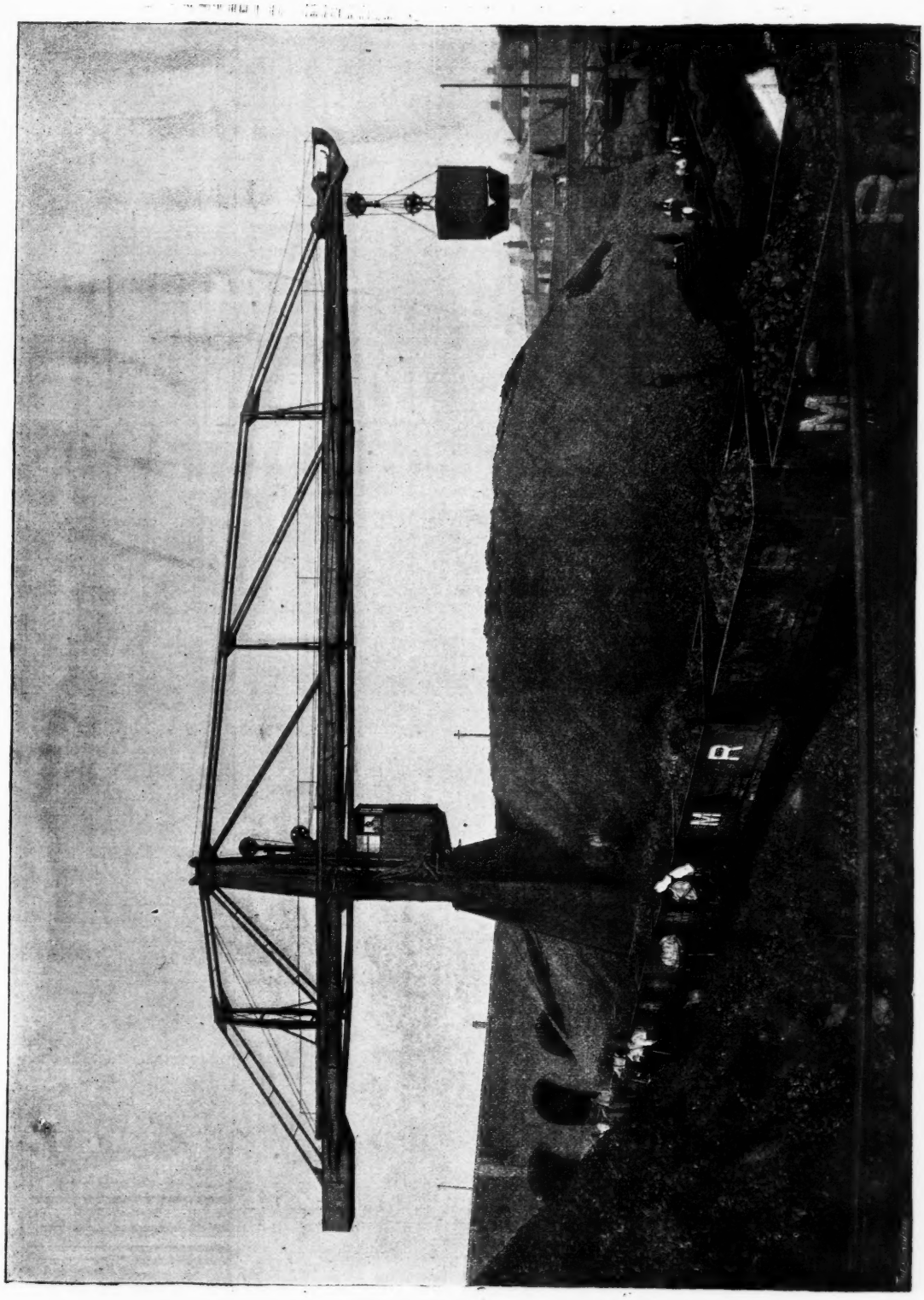


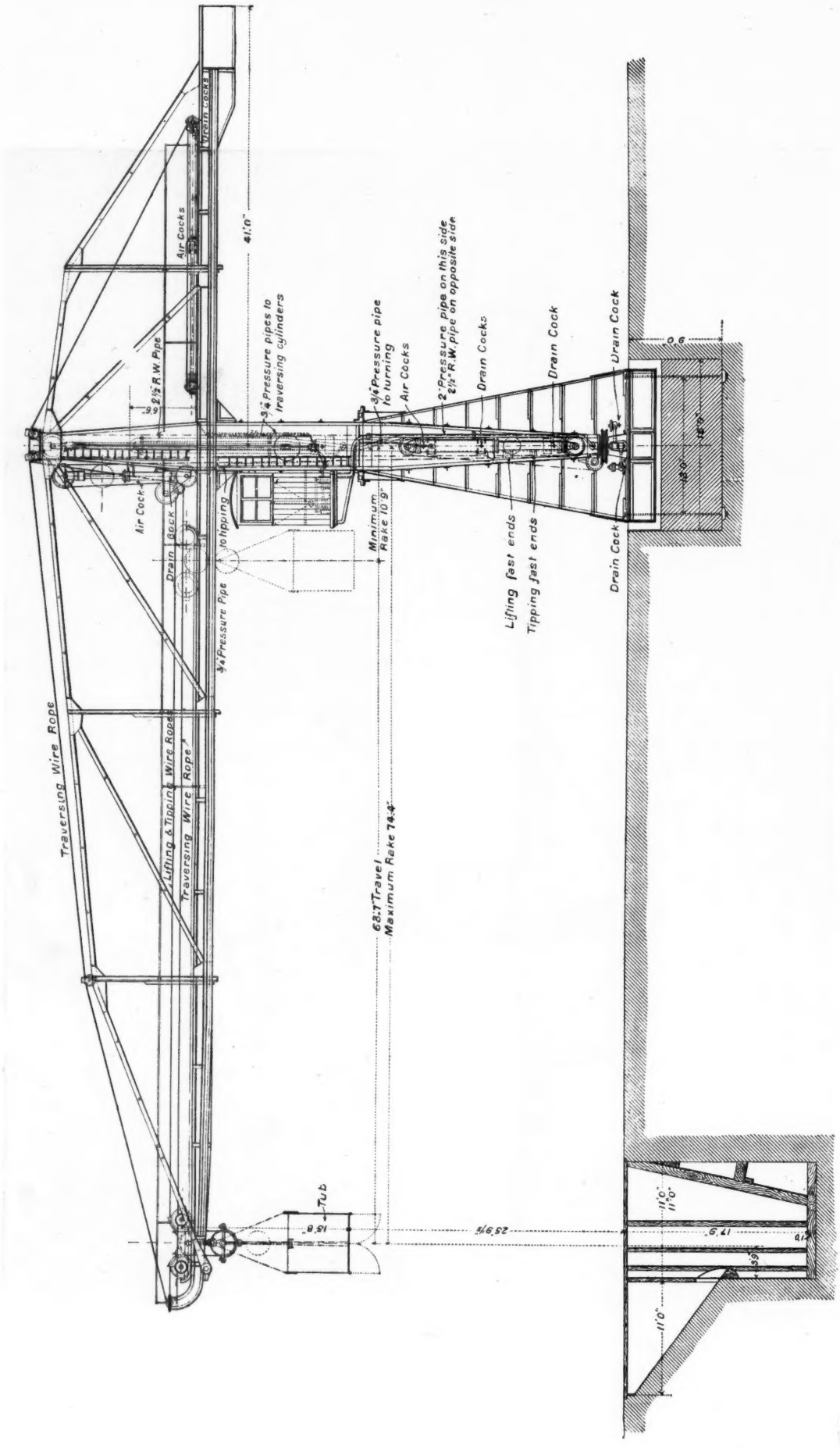
pressure is sufficiently increased to raise the gasholder bell, with its extra load of water. When increasing pressure, due to a lessening demand, makes the gasholder bell rise, notwithstanding the added weight of water, it becomes necessary to remove the water more or less gradually, because its weight is no longer required. To effect this, a "displacer" is employed, and is fixed in a stationary position over the loading-tank. As the bell rises, the water in the tank is pressed slowly up against the displacer, and is thus gradually forced out through a suitable passage. When all the water has been so removed, the normal, or constant, pressure will be re-established; the occasion for its increase having then passed away.

From the accompanying illustration (which is supplementary to the two that appeared in the JOURNAL for May 16 last), a general idea of the modification above referred to may be obtained. The loading-tank added to the bell, the cistern which supplies water to it, the electrically actuated valve that admits, and the fixed displacer that removes, the water from the tank, are all shown; and the whole arrangement will, no doubt, be readily understood. The invention includes other modes of applying the principle; but the one here shown will convey a knowledge of the means generally employed to carry the object into effect.

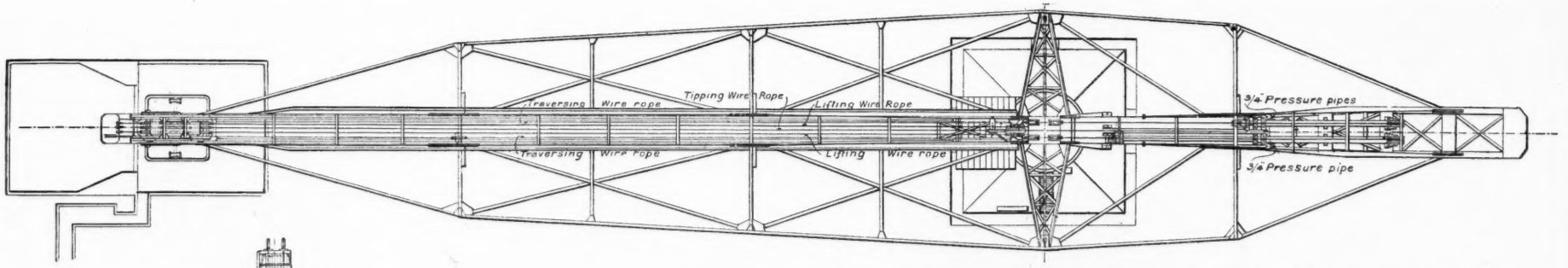
HYDRAULIC COKE-STACKING CRANE AT THE SALTLEY GAS-WORKS.

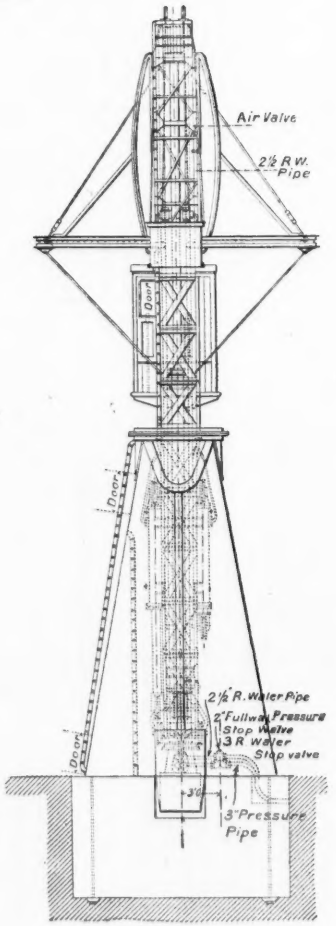
[For Description, see p. 85.]





HYDRAULIC COKE-STACKING CRANE AT THE SALTLEY GAS-WORKS.





HYDRAULIC COKE-STACKING CRANE AT THE SALTLEY GAS-WORKS.

As the stacking of coke is a matter of great importance to gas engineers and managers, we draw attention to a hydraulic crane of unusual proportions which has recently been erected and put in operation at the Saltley Gas-Works of the Birmingham Corporation, upon lines suggested by Mr. Henry Hack, M.Inst.C.E., the Engineer.

Before this crane was erected, the usual method of stacking coke by manual labour was adopted. This was not only very laborious and expensive, besides causing much waste, but disputes often arose with the men as to the division of the work, and the amount to be paid for it. The work is now performed in a most satisfactory manner by the crane, which is capable of raising and tipping 25 tons of coke per hour; and, when it is fully employed stacking coke at the maximum height, it saves 28 men in the 24 hours. The average cost of dealing with the coke after taking it over from the coke-wheelers, was formally about 6d. per ton; the same work is now performed by the crane for less than 1¾d. per ton.

The crane, as will be seen from the engraving, has a vertical pillar and long horizontal jib. The foot of the pillar is carried on a wrought-iron girder, which transmits the weight to a wrought-iron pedestal, the upper part of which takes the horizontal strain of the upper bearing on the pillar. The pedestal is fixed on a block of concrete, 16 feet square and 9 feet deep. On the jib, a bogie-carriage travels, from which is suspended a rectangular box for holding the coke. At the back of the pillar is the counterweight jib, at the outer end of which is stowed a counterweight partly balancing the structure. Both jibs are stayed vertically and horizontally from the pillar. The working hydraulic pressure is 700 lbs. per square inch.

The coke is at present wheeled from the retorts, and is constantly being tipped into a hopper in the ground; but arrangements are being made for conveying it, by mechanical means, direct from the retorts to the hopper. The box on the crane, which holds 2 tons of coke, is lowered into a pit adjoining the hopper. The coke is allowed to discharge itself from the hopper to the box; the flow being controlled by a sliding-door, actuated by a hydraulic cylinder. The box can be lifted through a height of 43 ft. 6 in. The maximum radius of the crane is 74 ft. 4 in.; and the horizontal travel of the box is 63 ft. 7 in. This enables coke to be stacked to a height of about 24 ft. 6 in. in a circle of 150 feet in diameter; giving, with the slopes, a storeage of about 7000 tons.

The lifting cylinder is placed within the pillar. The box is lifted by means of two wire ropes, which, after passing around sheaves on the lifting cylinder and ram, go over the bogie-carriage and running-blocks above the box, and are made fast at the end of the jib. A third wire rope passes around the lifting cylinder and ram, and thence over the ram-head of a small hydraulic cylinder, and on to the box, where it is attached to the bottom doors. By means of this rope, the doors are kept closed when the small ram is at its out-stroke; and the doors are allowed to open when the cylinder is exhausted. The travelling of the bogie along the jib is effected by a pair of horizontal cylinders, placed on the counterweight jib, and connected to the bogie by wire ropes. The crane is turned by two hydraulic cylinders fixed one on each side of the pillar. The chain from these cylinders passes around the turning drum, which is fixed to the bottom socket of the crane. All the motions are controlled by one man in a valve-house on the front of the pillar, below the jib; only one other attendant being required to work the hydraulic slide between the pit and the coke-hopper.

The foundations of the crane, also the work in connection with the coke pit and hopper, were carried out by the employees of the Gas Department under the direction of Mr. Hack. Considerable difficulty was, however, experienced in accomplishing this work, owing to the large amount of water to be dealt with, and to the fact that running-sand was met with a few feet below the surface. This led to considerable departure from the original drawings for this part of the work. For the bottom half of the pit, in lieu of Portland cement concrete walls, a cast-iron caisson had to be resorted to. This was made in sections; the plates being bolted together with flanges, and the whole forced through the sand by excavating inside and weighting the caisson in the usual way. The crane itself was constructed by Messrs. Sir W. G. Armstrong, Mitchell, and Co.; and it has been working for nearly six months.

The erection of a similar crane at Saltley for storing either coal or coke as may be required is, we believe, under consideration by Mr. Hack—the coal to be tipped direct from the railway trucks by hydraulic power into a hopper, from which it would be raised and deposited in the coal stacks by the crane, as is done with coke.

THE OZONINE PROCESS OF SEWAGE PURIFICATION.

Among recent developments in the treatment of sewage, one of the most promising is the "Ozonine" process of the Standard Sewage and Water Purification Company, which, after a most exhaustive experimental trial at the sewage works of the Salford Corporation, is now being applied to the whole of the sewage of that town, amounting to 10 million gallons per day. The speciality of this process consists in the use, as a precipitant and purifier, of ozonine—a specially-prepared chemical substance, consisting of basic persulphate of iron, or, in other words, ferric sulphate charged with an excess of peroxide of iron. It is chiefly to this excess of peroxide of iron that the superiority of ozonine over other iron salts is due. The peroxide retains the noxious sulphur compounds, and also acts as a carrier of oxygen to the organic matter, which it therefore tends to destroy by a process of slow combustion. There is a further advantage with ozonine over other iron salts that have been employed in sewage treatment. Being fully oxidized, it does not rob the sewage of its dissolved oxygen, as to the subsalts of iron; but, on the contrary, under suitable conditions, it gives up some of its own oxygen to the decomposing organic matter of the sewage. Thus self-purification of the sewage is facilitated; and, supplemented by additional oxygen through the agency of the chemical employed, the noxious constituents of the sewage are oxidized inert matters and innocuous gases. It is claimed for the ozonine process that it not only clarifies the sewage, but effectually purifies it; both the sludge and the effluent possessing very great immunity from after-decomposition. The latter can, therefore, be discharged into any river or stream without risk of fouling the water; and the former may be dried and then submitted to such treatment as may be found desirable without causing any nuisance.

In applying the ozonine, it is mixed with water, and run, in the proper proportions, into the stream of sewage, immediately before the latter enters the precipitation tanks. A little lime is also employed, if found desirable; depending upon the nature of the sewage to be treated. The combination of the chemical with the foul matters of the sewage is very complete; and a heavy flocculent precipitate is formed. To allow of the precipitate settling out of the sewage, so as to leave a clear effluent, the liquid must be perfectly quiescent for a considerable period. Given plenty of time for settlement, the deposition of the suspended precipitate is complete; but if sufficient time be not allowed, the heavier portions will fall down, and leave a light and almost impalpable floating precipitate, which gives a more or less opaque cloudiness to the effluent. At the time of our visit to the Salford sewage works, the experiment was being tried of agitating, for a few minutes, by means of an air-blower, the liquid sewage in the tanks with the deposited sludge from former precipitations. By this means the precipitate is consolidated, and settles much more readily; an hour's perfect rest being sufficient to allow the whole of the suspended matter to separate out, and leave a clear effluent. This treatment, however, forms no part of the Standard Company's system; as, given sufficient time for settling (which means tanks of ample size), quite as good results are obtained by natural settlement of the precipitate. Where tank space is a consideration, however, the blowing arrangement is an advantageous addition to the process.

The effluent obtained from simple precipitation and settlement consists of a clear liquid, or, at the worst, containing but slight cloudiness, and shows, on analysis, that 55 per cent. of the soluble albuminoid ammonia has been removed, in addition to the suspended matters. If still greater purity be required, the effluent is filtered, either through a filter of sand and gravel, or through an ozonite filter, which is another speciality of the Standard Company's process. By the former addition, the amount of soluble albuminoid ammonia removed is raised to 68 per cent., and by the latter to 73 per cent. If, however, the total albuminoid ammonia contained in the original sewage, in solution and suspension, is considered, the purification effected amounts to about 90 per cent.

An important advantage possessed by this process is that, so little time being needed, there is correspondingly small addition of weight to the sludge which has to be removed. As to this, it is claimed that the ozonite process yields a smaller weight of sludge than any other method of sewage purification.

THE RICHMOND WATER-WORKS.

Last Wednesday, the members of the Society of Engineers paid a visit to the new lock and weir works and to the water-works at Richmond. The party included the President (Mr. W. A. Valon, J.P.), the Vice-Presidents—one of whom is Mr. W. G. Peirce, the Borough Engineer of Richmond—several Past-Presidents and members of the Council, and the Secretary (Mr. G. A. Pryce-Cuxson). The visitors having been received by the Mayor (Mr. Alderman Bunt) and members of the Corporation, they were conducted over the lock and weir works by Mr. P. Le Neve Foster, the Resident Engineer, and over the water-works by Mr. Peirce. The former do not possess any special interest for our readers; but the latter call for notice, more especially as they have been on several occasions referred to in the JOURNAL in connection with some troublesome boring operations which have lately been successfully completed.

The present water-works were commenced in 1876, by the laying of about 22 miles of cast-iron mains, varying from 14 inches to 3 inches in diameter, with hydrants; the conversion of the old brewery at the bottom of Water Lane into a pumping-station; and the sinking of two wells—the dummy or pumping well, 8 ft. 6 in. in diameter by 140 feet in depth, and the artesian well 7 feet in diameter, reduced to 3 feet at a depth of 254 feet, on the surface of the chalk. From this level the boring commences; and it has been carried down to a depth of 1446 feet—varying from 2 feet to 7 inches diameter, terminating in the red sandstone. The expectation of a sufficient supply of water not having been realized from this source, a certain proportion of water is drawn from a shallow well, situated in the Petersham Meadows, 1100 yards distant from the Water Lane works, and connected by a 9-inch syphon pipe with the dummy or pumping well.

Owing to the steady increase of the population and the greater consumption of water for all sanitary purposes, the Water Committee took into consideration the necessity for increasing the supply of water; and in the year 1887, they requested their Engineer to prepare plans and estimates for sinking a new well to the chalk, and driving adits in various directions to intercept fissures, and by this means improve the supply. The well has been sunk 9 ft. 6 in. in diameter, in brickwork, through the London clay, reduced to 8 feet and 7 feet, with cast-iron cylinders, through the Thanet sands, and 6 ft. 6 in. into the chalk to the depth of 320 feet from the surface of the ground. At this depth adits have been driven 6 ft. by 4 ft. 6 in. in several directions, amounting to nearly 4000 feet; the greatest length in one direction—2378 feet—connecting the new well with the old well at Water Lane. It may be mentioned that, soon after starting the driving of the adits, the Corporation purchased the contractors' plant, and have since carried out this part of the work by their own men.

Owing to the limited quantity of water obtained from the wells, a duplicate system of mains and pumping plant has been provided, for giving a constant supply from the river for road-watering and sewer-flushing purposes. At present there are five pumping-engines, one 25-horse power Robey, two 50-horse power beam-engines (compound), one 25-horse power compound direct-acting, &c., and one 10-horse power special pump at work, with four steam-boilers—viz., three 50-horse power Field patent vertical, and one 25-horse power Robey semi-fixed—raising water from the several sources above referred to, the greatest depth being 320 feet from the surface of the ground (supplemented, when required, with a supply from the Southwark and Vauxhall Company) into a service reservoir in Richmond Park, 142 feet above the old pumping-station, having a total storeage capacity of 750,000 gallons. The reservoir, although built upon the highest ground in the neighbourhood, will not supply the top cisterns of about 40 houses on the Terrace by gravitation. For this a special balanced valve on the 14-inch main leading to the reservoir has to be closed daily while the pumping is continued to fill these high-service cisterns.

A contract has been entered into with Messrs. C. Simmins and Sons, of Runcorn, to fix 65 feet of new 4 feet diameter cast-iron cylinders inside the original 5 feet diameter cylinders, previous to enlarging the bore-hole from 2 feet to 3 ft. 6 in. diameter to the adit. It is intended to put down new plant for the purpose of pumping all the water obtained from the adits of the old works; thereby avoiding having two pumping-stations, and obtaining economy in the cost of fuel and labour.

The total consumption of water for the year ending the 25th of March last, was 207,769,428 gallons, averaging 569,305 gallons per day, and (say) for 23,000 consumers 24·7 gallons per head per day. The income on the water-works account for the year was about £11,500; the rateable value at the same date being £119,579.

Use of Alum as an Auxiliary in Water Filtration.—In some American water-works, alum is added to the water, in small doses, before filtration. This alum forms jelly-like particles, which seize the fine silt and minute organisms in the water, and drag them to the bottom. If properly used, most of it will be caught in the filter-bed. On the other hand, if an excess is employed, the amount in solution will pass the filter undecomposed, and the water will be correspondingly impregnated. The "dose" used depends entirely on the quality of the water. During 1892 the quantity used at Atlanta (Ga.) was 0·77 grain per gallon (U.S.) Mechanical filters are also largely adopted in the United States. One form consists simply of a tank, 14 feet high and 12 feet in diameter, open at the top, and partly filled with sand or sand and charcoal. The water passes through this filtering-bed to the bottom drains, which conduct it away. A revolving rake is used to stir up the top of the sand when it becomes clogged; the direction of the water being changed during the cleaning process. The results obtained vary considerably; but in general the filters reduce the amount of albuminoid ammonia by about 69¼ per cent. The suspended matter is reduced by about one-half; and 98 per cent. of the micro-organisms are removed.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by our correspondents.]

"Hawkite" Gas.

SIR,—Your correspondent, Mr. E. J. Davies, is at considerable trouble in retailing statements concerning certain experiments made by him while in the employ of the Hawkite Company; but readers of the correspondence must remember that in many instances the figures given as facts are the results of preliminary and uncompleted statistics of experimental trials. Mr. Davies had no objection to take four guineas a week to conduct these experiments; and, if they did not receive his "careful and elaborate investigation," he failed to do his duty to his employers.

The conclusions Mr. Davies jumps at as to the publication by the Directors of his report, which he prepared and wrote out without my help, and which two competent engineers readily signed, are stupid in the extreme, and only show Mr. Davies in his right light. For my own part, I have neither time nor inclination to bandy words with Mr. Davies, as to what his opinion may be about "Hawkite" gas. Actual demonstration is worth more than a volume of opinions.

I may add that the two Engineers who willingly signed the report in conjunction with Mr. Davies, have no reason for regretting their action in the matter. But then they do not happen to be former servants of the Company, whose further services have been dispensed with.

W. H. FULLER, Managing-Director,
July 7, 1893. Hawkite New Motive Power Co., Ltd.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bills reported: Electric Lighting Provisional Order Bill (No. 7); London County Council (Subways) Bill; Water Provisional Order Bill (No. 3).

Bills referred to a Select Committee, consisting of Lord Clinton (Chairman), Lord Braye, Lord Colchester, Lord Hatherton, and Lord Iveagh, to meet on Monday, July 10: Greenock Corporation Bill; Leeds Corporation (Consolidation and Improvement) Bill; Water Provisional Orders Bill (No. 2).

Bills read the third time and passed: Electric Lighting Provisional Order Bill (No. 7); Water Provisional Order Bill (No. 3).

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bill read a second time and committed: Gas Orders Confirmation Bill.

Bills reported: Belfast Water Bill; Gas Orders Confirmation Bill.

Bills read the third time and passed: Electric Lighting Provisional Orders Bills (Nos. 5 and 6); Runcorn Commissioners Bill.

HOUSE OF COMMONS COMMITTEE.

(*Before Mr.* SAMUEL SMITH, *Chairman; Mr.* CAVENDISH BENTINCK, *Mr.* CHANNING, *Mr.* WINGFIELD DIGBY, *and Mr.* BONHAM CARTER, *Referee.*)

Tuesday, June 27.

CRYSTAL PALACE DISTRICT GAS BILL.

This Bill—which is to empower the Crystal Palace District Gas Company to raise additional capital, to convert their existing authorized capital and debenture stock, to provide for the sale of new stock to consumers of gas in the Company's district as well as to their employees, to alter their Act of 1873 in respect to the quality of gas, and to authorize amalgamation with any Metropolitan Gas Company south of the Thames—came before the above Committee to-day. A report of the proceedings on the Bill when before the House of Lords Committee appeared in our issues for May 2 and 9 last.

Mr. BALFOUR BROWNE, Q.C., Mr. MEYSEY THOMPSON, Q.C., and Mr. FREEMAN represented the promoters. The Bill was again opposed by the London County Council, for whom Mr. POPE, Q.C., and Mr. MOON appeared, and by the Beckenham Local Board, who reserved Counsel.

Mr. BALFOUR BROWNE opened the case for the promoters; and, speaking of the opposition of the County Council and their proposal to bring the Company under the jurisdiction of the Metropolitan Gas Examiners, he said that since 1860 the Company had worked and extended its system on the strength of not being in the Metropolis, and being absolutely free from the very peddling and meddling action of the London County Council—the action of their Examiners having without doubt resulted in a serious increase in the price of gas to the consumers in London. It was not a matter between the Company and the County Council merely, but between them and other Local Authorities. The Beckenham Local Board protested against any alteration in the Bill.

Witnesses were then called on behalf of the promoters.

Mr. *George Livesey*, examined by Mr. MEYSEY THOMPSON, first of all formally proved the unopposed parts of the Bill. With regard to the provision relating to the question of sulphur, he said it had been introduced by agreement with the Local Authorities; but it was more onerous than he should have liked. Coming to the important point between the London County Council and the Company, he stated that he was well acquainted with the legislation by which The Gaslight and Coke, the South Metropolitan, and the Commercial Gas Companies were specifically placed under the jurisdiction of the Gas Referees. All other Companies were expressly excluded, because only small portions of their districts were within the Metropolis. Assuming the jurisdiction of the Referees did extend to a small part of the areas of the outlying Companies, it would practically enable them to control the supply of gas throughout the entire districts. By the Gas-Works Clauses Acts of 1847 and 1871, it was now left to the different Local Authorities to test the gas, and see that the requirements of the Acts were complied with; and they had done so. In the case of the Crystal Palace Gas Company, the Local Authorities had appointed their own testers; and the gas had been systematically tested by them. In his opinion, it would be most unreasonable, and most detrimental to the interests of the consumers, that the jurisdiction of the Referees should be extended to the district of the Company.

Mr. MEYSEY THOMPSON: What do you find to be the effect of the action of the Referees within the Metropolis?

Witness: As a matter of fact, it has the effect of making the life of a gas-works manager perfectly intolerable. Every morning, on arriving at his office, he never knows what the test may be. He may have done his best to send out gas of the proper quality, and has done so; but through the inefficient method of testing, the use of candles, and one thing and another, gas, which he believes to have been of 16-candle quality, may be returned as of only 15-candle power. This involves an appeal to the Chief Gas Examiner; and if it is known to him that the test has been properly made, he disallows the appeal, and then the Company is summoned before a Magistrate, who imposes a penalty. The effect of this is to so worry the managers that their time and attention are given, to a very large extent, to these pettifogging questions of testing, to the neglect of the important matters of the general management and improvement of the business.

Do you consider such action on the part of the Referees is necessary, in order to ensure a proper supply of gas?—Certainly not. What ensures a proper supply of gas is the complaints of the consumers. If they are not obtaining a good supply, they send letters to the Company; and I can assure the Committee that the general desire of the Companies is to avoid these complaints. They may come at a time when the gas-testing shows the gas to be perfectly right; and they often arise through a deposit of naphthalene in the pipes. The South Metropolitan Company have at times as many as 1000 complaints in a day of deficient supply, owing to accumulations of naphthalene in the pipes, which occur when great alterations of temperature take place. On these occasions, the gas would probably be returned as all right at the testing-places. It is the great object of gas companies to satisfy their consumers, particularly now that they are exposed to competitors—for instance, cheap oil (which is a serious competitor) and the dear, but attractive, electric light. The effect of the action of the Referees has been to distract our attention, and to cause us to use expensive methods of enrichment; and I am sure I do not overstate it when I say that, in consequence of this, the price of gas in London is from 1d. to 2d. per 1000 cubic feet more than it would be otherwise.

And, of course, the result of any increase in price falls more heavily upon the consumer than upon the Company?—Under the sliding scale arrangement, it is not a partnership in name, but it is one in reality—the consumer obtaining five-sixths of the benefit. Taking the three London Companies, supposing they saved £6000, £5000 would go to the consumers in reduction of price, and £1000 to the shareholders in increase of dividend.

Therefore, really the interest of the consumer is far greater than that of the Company in the reduction?—Yes; but the interest of the Company is quite enough. We have a double interest in reducing the price—first, to get a small increase in the dividend; and, secondly, to satisfy our consumers, and to hold our own against competitors. Moreover, it must be remembered that a very large quantity of gas is now used for cooking, heating, and motive purposes. This is increasing greatly year by year; and if we are obliged to raise the quality to comply with the requirements of the Referees, and to advance the price by 2d. per 1000 cubic feet, it would be a dead loss to everybody who requires gas for use in the daytime for any other purpose than lighting. The increased illuminating power is of no advantage to them, because they have to pay more for it than it is worth.

Examination continued: Before the Metropolitan Board of Works began the testing of the gas, the parishes used to test it. If they found the quality below the standard, they notified it to the Company; and the Metropolitan Board of Works used to ask for, or accepted, an explanation, instead of exposing the Company to the trouble and annoyance of a prosecution. He might say that, in nearly all cases, the Company had a reasonable explanation; and the authorities were satisfied, and did not proceed further. But now, under the County Council, they would listen to nothing. He did not blame them. The Act, he believed, required them to prosecute in every case—at any rate, for any failure to comply with the requirements of the Act. But, as Mr. Vernon Harcourt, who appeared in one case, said: "It is a most decidedly unsatisfactory position in which to place the Gas Companies, to sandwich them in police courts between thieves and drunkards." Although it was not always published in the newspapers, they were summoned very often. They did not like being hauled up before a Magistrate, and made to appear as criminals, when they were honestly doing their best to serve the public. There were no such provisions for testing gas in the whole world as those which applied to the three Metropolitan Companies; and no other company was subjected to such annoyance, loss, and inconvenience as they were. Throughout the whole kingdom, the ordinary law prevailed; and it was satisfactory and sufficient. There was no reason whatever why the Crystal Palace District Gas Company should be placed under different conditions to other districts in the country. Having been the Manager of the South Metropolitan Company, he could say that the legislation under which the three London Companies worked was simply intolerable, and was of no benefit to the public, but rather the reverse; and, in fact, they were going to get it altered.

Mr. MEYSEY THOMPSON: Then you would oppose, in the strongest possible way, any extension of the jurisdiction of the Gas Referees?

Witness: Yes; or of the London County Council. I may give an instance that has happened just recently. The South Metropolitan Company's gas has hitherto been tested by the County Council at six

different stations, with candles made by recognized makers—Messrs. Miller and Messrs. Brecknell and Turner; and these candles have been used for many years. A fortnight ago the County Council sent a notification to the Gas Companies that henceforth they would not confine themselves to these candles, but that they would get any candles that their Chemist might find complied with the Act. We (the South Metropolitan Company) thought it would make no difference, and accepted this. But, to our great astonishment, a few days ago a report was brought to us that, at one testing-station, the quality of the gas had suddenly been reduced from 16½ candles to under 14 candles. Our Engineer inquired into the matter, and found that some new candles had been introduced. According to our test, the quality was precisely the same—16½ candles on one day and 16½ candles the next. I believe it would be admitted by the Chemist of the Council that the apparent difference was due entirely to the introduction of these candles. They contend that the candles as now made do not give so much light as they used to. We maintain that this is not correct. However, the change of candles has apparently reduced the illuminating power of the gas from 16½ candles to 14 candles, and the Company will no doubt be summoned for this and fined; and we object to these capricious acts.

Witness was cross-examined by Mr. Moon, in the first place, as to the testing arrangements in the Crystal Palace Gas Company's district. Lewisham had appointed their own special Examiner; and he tested the gas as often as they ordered him. For the small portions of the Battersea, Camberwell, and Lambeth parishes in the Company's area, no testers had been appointed.

Mr. Moon: Now, supposing that Lewisham, Battersea, Lambeth, and Camberwell are anxious that the County Council should be appointed the testing authority——

Mr. Meysey Thompson: I must object to this. Lambeth and Camberwell both appeared in the other House, and were parties to an agreement come to between the Company and the Local Authorities; and they went away satisfied. Therefore they could not appear here, because it would be a violation of the agreement with the Company. It is a monstrous thing that the County Council should now say they are not satisfied.

Some little discussion between Counsel followed on this point, in the course of which

Mr. Moon claimed that he could call witnesses to show that those Local Authorities did require the jurisdiction of the County Council to be extended to them, although they did not petition; but he would abstain from asking further questions on the point.

In further cross-examination, witness said he should object to the County Council being the testing authority of those various parishes, because they might introduce candles that would show the gas to be two candles less in illuminating power than it really was; and the Company could not prove they were wrong, as the candles were in accordance with the vague definition of the Act of Parliament, which, he added, required amendment.

Mr. Moon: I think at the present moment a Committee appointed by the Board of Trade is discussing this question of testing; and the result will be to determine the standard to be used.

Witness: I am a member of that Committee; but we have spent a great deal of time, but so far have come to no conclusion.

Assuming that the methods hitherto prescribed of testing the illuminating power are continued until the Board of Trade determine upon some other method, should you then object to the County Council being the testing authority?—Yes, because I consider they have shown that they do not act fairly in this matter of selecting candles. The other authorities select the recognized candles, and test the gas fairly; but, to bring in candles which show the gas to be of two candles less power than it has been for the last five years by other candles, is too bad. I admit that they have acted within the terms of the Act, which gives them very wide discretion.

Therefore, provided the Act did not give them this wide discretion, you would not object to the County Council being the testing authority?—You cannot help giving them the discretion. The Committee cannot prescribe what candles are to be used everywhere.

But if you can persuade the Board of Trade that the present standard is wrong, they can prescribe a different method?—Yes; but from my experience of the Committee, we are at a deadlock, and whether or not anything will come of it, is not at all certain.

If you are dissatisfied with the reports of the County Council examiners, you can appeal?—Yes; to the Chief Gas Examiner, who, unfortunately, has had no practical experience in the manufacture of gas. He is a very good chemist, and that is all.

Have you told the Board of Trade that you think he has no knowledge of the business?—No, I have not; nor should I have done so here, had you not asked me the question. The Chief Gas Examiner is a most fair man, and a thoroughly honourable gentleman. When we were under the Metropolitan Board of Works, they acted reasonably; but I am not blaming the County Council. We did not then appeal, as a rule, to the Chief Gas Examiner. We sent a statement to the Board whenever there was a deficiency, explaining why it was, and the result of that generally was that they expressed themselves as satisfied, or at any rate let the matter drop. But, as soon as the County Council were appointed, they said: "We have no discretion. We must let the matter take its course." I admit they may be right. I do not think that, strictly speaking, they have any discretion.

In reply to other questions, witness stated that, when the Chief Gas Examiner had certified that he could not allow an appeal, the Company had over and over again asked the Council to receive the penalty; but they had always said: "Oh, no; you must go through the indignity of being summoned before a Magistrate." He did not find fault with the Chief Gas Examiner, but with the system.

Re-examined: The County Council were entirely with in the letter of the Act in getting any candles that were known as sperm candles, burning 120 grains an hour. The Board of Trade Committee to which he had referred was appointed at the instigation of the South Metropolitan Company, who had promised to bear the expense.

By the Committee: The Chief Gas Examiner of the County Council had made certain investigations with regard to the candle, and had reported that it was a very unreliable standard.

The Chairman: According to this Bill, the test prescribed is Sugg's "London" Argand No. 1 burner?

Mr. Moon: As regards that clause, we are perfectly willing to meet the promoters of the Bill, and have it altered, so that the standard shall be, or the mode of testing the illuminating power of the gas shall be, that prescribed by the Board of Trade as the result of the pending inquiry.

Witness: I ought to explain that you will see, in the middle of the clause, that the Dibdin 10-candle pentane standard is to be used. I was asked by Counsel, when we were before the Committee of the House of Lords, whether I would agree to that. Mr. Dibdin had previously discussed the matter with me, and I said "Yes;" but I then believed it was a satisfactory new standard. I was under the impression that the Board of Trade would adopt it. But since then it has been discovered that it does not correspond with the candles—in fact, not merely the three London Companies, but the Chief Gas Examiner for the City and Mr. Dibdin himself agree that this standard gives more light than 10 candles. Mr. Dibdin's contention is that it gives the same light as ten of the candles he has recently introduced. But, at any rate, it gives considerably more light than the candles that are recognized as gas-testing candles; and there is now no probability of the Board of Trade Committee adopting it. We wish to alter the clause, and fall back upon candles, till Parliament, on the motion of the Board of Trade, introduces a new standard.

In reply to Mr. Bonham Carter, witness stated that Messrs. Miller and Messrs. Brecknell and Turner had specially laid themselves open to make candles with extra care for gas-testing purposes. He believed Mr. Vernon Harcourt had taken a great deal of trouble over this matter, and had seen Mr. Miller a good many times, with the result that the amount of strands in the wick, and the method of making the latter, had been altered, so that the candle should burn more uniformly.

Mr. *H. E. Jones*, the Engineer of the Commercial Gas Company, examined by Mr. Meysey Thompson, said that the Gas Act of 1860 specially excluded the outside districts; and he thought it was the intention to exclude them, because it was felt that a system of testing and examination that would well apply to the supply of gas in a rich and populous area like the City and West-End of London, was somewhat too rigorous for outside companies. The working of the Gas Referees led to an enormous increase in labour and trouble, and to a certain amount of expense, a large part of which was incurred in keeping a staff for the purpose of watching. Frequently, at the end of three months, the Chief Gas Examiner would report that his Company had been, taking the average, well within the standard in regard to purity, and above the standard as to illuminating power, and yet there would have been in the period three or four occasions on which they had been dragged into a police court, and had to pay a forfeit of 40s. This was a small thing in itself; but it exposed them to the odium of their customers, who thought that in some way they had been "cheating at the game." The supervision in the case of the Suburban Companies was sufficient to produce a gas of good general average quality. In the London works where they gave their stokers a rest for 16 hours on Sunday, they had to start all their work afresh on Monday, and it was identical with what they would have to do in starting new works. Therefore on Monday mornings they ought to have some allowance; and in future legislation they must take care to get it. It might interest the Committee to learn that in the case of the Commercial Company, as the men insisted on being paid double time if fogs or any other cause drove them to work through Sunday, they paid as much as five days on the eight-hour system for 24 hours' work. Assuming that the little bits of the parishes in the Crystal Palace Gas Company's area which had been referred to were placed under the jurisdiction of the Referees and the control of the London County Council, that would in effect place the whole district under their control, because the gas could not be supplied to one end of the district without being distributed over the whole of it. Therefore, whether they wished it or not, the expense of the gas made would be increased throughout the areas of the other Local Authorities.

In cross-examination by Mr. Pope, witness stated that he really thought the London Companies were looked after too carefully; and he did not think this microscopic supervision ought to be applied to the Crystal Palace Gas Company, on the ground that they had not such a profitable area of supply. If the parishes had not appointed examiners, it was a testimonial for the Company, because, if there had been any grievances, they would very soon have been discovered. What was good enough for Liverpool and other large towns was surely good enough for Sydenham: It appeared very strange that, when gas-works passed into the hands of local authorities, they seemed to let the testing go. He corroborated what Mr. Livesey had said as to the change which had been made by the London County Council in the candles employed in testing, and added: "I think it is very unfortunate for a great Council like that to take such a step as this; and I cannot help thinking it is a sort of a little slap in the face for us because we [the Committee on Standards of Light] would not take and put in the standard that has been selected by a gentleman in their service."

Mr. *Corbet Woodall* was also briefly examined in regard to the gas-testing question. He said that his experience of the testing of gas by Local Authorities in the country was that it had always worked satisfactorily. For a number of years he was Engineer of the Phœnix Gas Company, which was one of the Companies supplying London before amalgamation reduced their number. For some ten years after the Metropolitan Board of Works were testing the gas supplied by the other Companies, the gas produced by his Company was still examined by the Vestries and District Boards; and he believed the result of these testings was quite as satisfactory, from the consumers' point of view, as was the testing by the Metropolitan Board in the case of the other Companies. If the Vestries felt they had reason to complain, they did so direct to the Company, and the matter was dealt with; but he could hardly remember a case within ten years of a direct complaint of faulty supply. He did not know of any advantage which would be gained by the County Council testing the gas to compensate for the greater trouble and inconvenience. Having regard to the interest consumers had in the business under the sliding scale, he did not think such minute examination was necessary.

Cross-examined: He did not know of any large town that was not divided up into parishes, and almost invariably had only one gas company. Respecting the Phœnix Company, from his point of view, the testing by the Local Authorities answered admirably.

Mr. FREEMAN: My learned friend says, "from your point of view;" but was it satisfactory from everybody's point of view—there were no complaints were there?

Witness: That is so. I speak very decidedly that my recollection of the period during which the Company served a great number of the Local Authorities is that the supply was perfectly satisfactory, and there was no failure, and no difficulty about methods of testing.

By the CHAIRMAN: The Crystal Palace Gas Company had only one manufacturing station; so that the gas distributed throughout the district must be of the same quality as it left the works.

Mr. MOON then addressed the Committee for the London County Council, urging that the question was whether the Company should be under efficient control for the purpose of seeing that they carried out the obligations which they professed to Parliament they were willing to carry out, or whether the control should be placed in hands which would, in practice, undoubtedly prove to be inefficient.

Dr. *W. J. Collins*, Chairman of the Public Control Committee of the London County Council, said that the Committee had supervision of all matters relating to the gas supplied in the Metropolis; and it was proposed to include that portion of the area supplied by the Crystal Palace Gas Company which was within the County of London, and which included portions of Lewisham, Camberwell, Lambeth, and Penge, so that there might be the same control as there was in regard to the three other Companies. The representatives of the parishes within the County of London had signified their assent to the County Council assuming that jurisdiction.

Mr. MEYSEY THOMPSON (interposing) remarked that in gas matters the Local Authorities represented themselves, and not the County Council. An arrangement had been come to between the promoters and the Local Authorities, and this ought not to be disturbed by the County Council.

A long discussion ensued as to how far the County Council had been assenting parties to the agreement arrived at in the House of Lords, which was terminated by

The CHAIRMAN stating that the Committee thought the County Council could be heard on its own account, but not as representing the Local Authorities which agreed to the Bill.

Witness, proceeding, said that he was of opinion that the jurisdiction of the Council in London was in the interests of the public; and the reports of their Chemist indicated that, if there were not a strong controlling authority, the lapses of the Gas Companies would be much more frequent than they were. The tests of the examiners appointed by the Local Authorities would, he thought, be unsatisfactory. From the evidence laid before them by their Chemist, they had reason to think that there was deterioration in the illuminating power of the candles which had been employed for testing; and, after the Committee had thoroughly considered the matter, they came to the conclusion that the Chemist should be permitted to make tests with any candles which complied with the statutory limits, having previously notified to all the Gas Companies under their supervision the kind of candles which he intended to supply. This had been done within the last month; but they had not yet pressed for any penalties on the strength of the new tests. The Council desired to bring the Crystal Palace Company into line with the other Companies with reference to the power of supervising the tests.

Mr. MEYSEY THOMPSON, in cross-examining the witness, pressed him as to whether the County Council had followed the practice of the Metropolitan Board of Works in requesting from the Companies explanations in the case of failures before proceeding for penalties; and he said that the only instance in which the Council had asked for explanations was at the time of the coal strike, when the Chief Gas Examiner exonerated the Company.

Mr. *W. J. Dibdin*, Superintending Gas Examiner to the County Council and the Metropolitan Board of Works, since 1876, said that the practice of both bodies in dealing with the question of forfeiture caused by the infringement of obligations was exactly the same. The only reason that could be given for the statement that there was a difference in practice was that about the year 1888 considerable controversy arose upon the question of the standard candle. The Gaslight and Coke Company, the South Metropolitan Company, and the Commercial Gas Company, made representations to the Board of Works; and, on account of the uncertainty which then prevailed, there were two or three cases in which the Board did not proceed against the Companies upon the results of certain tests. But there was no definite and permanent departure from the ordinary course of receiving the report of the Chief Gas Examiner, and instructing the Solicitors to take proceedings in the usual way; and the practice was the same now as then. Within his knowledge, the Metropolitan Board never asked for an explanation from the Companies—that being the special function of the Chief Gas Examiner, in connection with the Companies' appeals. Witness explained the circumstances under which the altered candle had recently been brought into operation. It was owing to the deterioration of the candle, which amounted to about 1¼ candles on 16-candle gas. The whole question having been gone into before the Board of Trade Committee, Mr. Livesey and himself agreed specifically to a certain standard, which should be adopted—that was to say, the value of 1 candle in a pentane Argand, burning under specified conditions. This being taken as the standard candle, other details were proceeded with, when the Companies evidently found that they had not realized the importance of the change, and made a declaration that they would not agree to any standard, unless it gave them the full value of the altered candle since the passing of the Act—that was, they would not come to any compromise between the parties with regard to the alteration; but they would have the full benefit of the altered candle. Upon this, he felt it to be his duty to report the whole of the circumstances to the Committee of the County Council, who gave him instructions to obtain candles other than those which they had been obtaining from the maker who had altered, in good faith, his method of manufacture; and if those gave the same result as the candles in use at the same time as the passing of the Act, they were to be used. He carried out their instruction; and this was the action of which the Companies now complained. Among the functions of the Gas Referees appointed by the Board of Trade was that of prescribing and certifying the method adopted in testing the gas; and they also inspected the works and testing-stations. In his experience, it did not follow that the quality of the gas distributed in different directions was necessarily the same, nor did it follow that, because the result of the test was satisfactory within the County of London jurisdiction, it must necessarily be of the same quality outside. He did not think the Companies would supply as good gas as they did if they were not looked after by the London County Council. He did not think the Local Authorities had been able to enforce an efficient supply of gas. His impression was that the gas supplied by the Crystal Palace Company to the district within the area of the London County Council was not shown to be up to the standard of 14 candles, except on one occasion, and that was when the lower value of candles was used. In January, the gas was tested four times at the Board Schools at Lower Norwood, and Westow Hill and Salter's Hill (Norwood), when it ranged from 12·6 to 13·4 candles.

Mr. MEYSEY THOMPSON asked if the instruments used for testing were the legal ones as prescribed by the statute.

Witness said that it was an exact copy of the instrument authorized by the Gas-Works Clauses Act; and if it was put into one of the specific gas-testing stations, the Company could have been proceeded against for penalties upon the result of the test.

Cross-examined by Mr. MEYSEY THOMPSON, witness said they never gave notice of the proposed testings to the Company; and also that the instrument used was a travelling photometer, to which other Companies had objected. The percentage of cannel coal used by the Company for enriching their gas had steadily decreased from 1881, when it was 4·43, to 1891, when it was 0·49; but he had not any particulars as to the amount of petroleum spirit which they used, as he was under the impression that petroleum spirit had only begun to be employed to any extent for enriching gas within the last year or two. Up to 1891, practically there was none used. He did not know that the cannel coal recently carbonized by the Company gave 30-candle gas, as against 20-candle gas produced by that used in 1881. He maintained that, under the Board of Works, the cases where the Company were in default which were followed by a prosecution were as large a percentage as under the County Council.

Thursday, June 29.

The case for the County Council being closed,

Mr. MEYSEY THOMPSON asked permission to call the Engineer of the Crystal Palace Gas Company with reference to the tests put in by Mr. Dibdin.

Mr. MOON remarked that he could not object.

Mr. *C. Gandon* said he had examined the tests put in by Mr. Dibdin, and produced the Company's records of tests taken on the same days. On Jan. 12, when Mr. Dibdin's test showed an illuminating power of 13·4 candles, the Company's test was 16·82 candles; on Jan. 16, the figures were 13 candles, against 14·55 candles; Jan. 17, 12·6 candles, against 15·94 candles; on Jan. 18, 13 candles, against 15·32 candles; March 3, 13·4 candles, against 16·02 candles; March 6, 12·5, against 14·43 candles; March 7, 12·5 candles, against 14·91 candles; March 8, 13·3 candles, against 14·85 candles; and March 9, 14 candles, against 15·16 candles. The Company's tests were taken at their testing-place about a mile from the works, which had been certified by the Board of Trade as a proper testing-station. It was of the utmost importance that the places where tests were taken should be carefully prepared for the purpose. It was impossible to make accurate tests, unless they were taken in a properly constructed building. There were photometers which did not require an absolutely dark room; but he did not look upon them as so reliable as those used in a dark room. He should think a Board School room was most decidedly not a proper place to take a test in. He could scarcely imagine it possible to fit up temporarily a photometer by which a reliable test could be taken, especially as a peripatetic portable photometer was used. If notice had been given to him of the tests, he should have pointed out that it was not a satisfactory instrument.

Mr. MEYSEY THOMPSON having addressed the Committee,

A private consultation was held, after which

The CHAIRMAN said the decision of the Committee was that the preamble of the Bill was proved. They had carefully considered the proposal of the London County Council; and they considered that the provisions for carrying it out could not be inserted in the Bill.

The Committee then went through the clauses of the Bill, and ordered it to be reported to the House for third reading.

Impending Crisis in the Coal Trade.—Our Bolton correspondent writes: We are on the eve of a great crisis in the coal trade; and it promises to bring about the most colossal suspension of labour the public have seen. The Coalowners' Federation demand 25 per cent. reduction in wages; and, according to the men's leaders, this will not be conceded without a terrible struggle. Notices to finish contracts are already being given by the employers; and unless some compromise is effected in the meanwhile, between 300,000 and 400,000 colliers will be out on the 28th inst. Throughout the Federation districts, meetings of the men are being held, at which delegates are appointed to attend a special conference to take place in Birmingham on the 19th inst. Two days before this there will be a conference of the Lancashire and Cheshire Miners' Federation at Manchester, when reports will be submitted as to the opinion of the districts on the proposed reduction; and the delegates to the Birmingham meeting will be instructed how to act. Many of the Lancashire colliery owners would prefer to keep their concerns at work in the event of no settlement being effected; but the rule is that all pits must be idle or otherwise at the same time. The men do not believe that the masters seriously mean to enforce a 25 per cent. reduction, but would be content with less than half. It is well known, however, that the settled policy of the Miners' Federation is to hold out against any reduction whatever. The fact is, the very existence of the Miners' Federation is threatened; and the leaders are fully aware of it.

LEGAL INTELLIGENCE.

LAMBETH POLICE COURT.—Wednesday, July 5.

(*Before Mr.* SHEIL.)

The Southwark and Vauxhall Water Company Fined for Cutting off a Supply.

To-day his Worship was engaged in hearing a summons taken out by Mr. R. Day, residing at Richmond Terrace, Clapham Road, against the Southwark and Vauxhall Water Company, for neglecting and refusing to supply water to his premises.

Mr. SALTER appeared for the complainant; Mr. S. LYNCH represented the Company.

Mr. SALTER, in opening the case, stated that on the 24th of May last the complainant was indebted to the Company for three quarters past water-rates, and the current quarter's rates; the total amount being £2 6s. On the day in question, an officer of the Company attended the complainant's house, and demanded the £2 6s., and an additional 15s., which he said he must have as well, for coming down. The complainant declined to pay more than the £2 6s.; and the water was thereupon cut off.

Mr. SHEIL: Is there any dispute as to the facts?

Mr. LYNCH: If the £2 6s. was tendered before the water was cut off, I agree that my friend is right.

Mr. SHEIL: Then you say the water was cut off before the rate was tendered?

Mr. LYNCH: Yes, Sir.

Complainant was called, and gave evidence bearing out the opening statement of the Counsel. He said that, when he offered the Company's officer £2 6s., the man refused to take the amount, and then and there cut off the water.

In cross-examination, witness adhered to his statement that the rates were tendered before the water was cut off. He added that he had made continual complaints to the Company about the inadequacy of the supply.

By Mr. SHEIL: When the Company's officer called, witness showed him the money—two sovereigns and six shillings.

Mrs. *Day*, the complainant's wife, and Mr. *Gieve*, a neighbour, gave corroborative evidence; both witnesses agreeing that the officer refused to take the £2 6s. tendered, on the ground that his instructions were to obtain £3 1s., or to cut off the water.

Mr. LYNCH, for the defence, said many demands had been made for the rate before the extreme course of cutting off the water was adopted. The Company's officer, King, went to Mr. Day's house and demanded the rate before a pick was put into the ground; but he did not demand the extra 15s., as alleged.

Mr. SHEIL remarked that, if it were a mere question as between the Company's collector on the one hand, and the complainant and his witnesses on the other, he should attach credence to the latter.

Henry King, a ground-man in the service of the Company, said he went to the house and informed Mrs. Day, who was the only person he saw, that he had come to cut off the water. Mrs. Day told him that Mr. Day had gone to the office to pay the rates. He waited for some time to see whether or not Mr. Day returned; and, as he did not, he cut off the water. Witness did not know how much was due, and did not demand £3 1s.

In cross-examination, witness stated that he usually knew how much was owing.

Mr. SHEIL said it was quite plain to him that, unless perjury had been committed, £3 1s. was asked for, and that £2 6s. was tendered. He ordered the Company to pay a penalty of £10, and £5 5s. costs.

New Joint-Stock Companies.—The Uttoxeter Gas-Works, Limited, has just been registered, with a capital of £7500, in £5 shares, to take over the property of the Uttoxeter Gas Company, in accordance with the arrangement recently come to by the shareholders, as recorded in the JOURNAL last week. The Cera Lamp and Stove Company, Limited, with a capital of £30,000, in £1 shares, is to carry into effect an agreement for the acquisition of the business hitherto carried on by the Cera Light Company, Limited.

Exhibitions of Gas Appliances.—Owing to the success of their exhibition in St. James's Hall, Manchester, Messrs. Richmond and Co., Limited, have just held another, in the Hulme Town Hall. Mr. Nickson, Superintendent of the Gas Department, on two occasions gave a graphic address on the advantages of cooking by gas, which was highly appreciated. During the continuance of the exhibition, lectures were given twice daily by Miss Owen.——Messrs. R. and A. Main have been exhibiting their gas stoves and cooking appliances at Broughty Ferry, with Miss M. Macleod Brown as lecturer and demonstrator; Mr. A. P. Main also giving a lecture on cookery, ancient and modern, illustrated by limelight views.

Water Supplies and the Recent Drought.—The stock of water in the case of several large cities and towns continues to diminish. At Manchester it was reported last Wednesday that they had 43 days' supply in the reservoirs, whereas a fortnight previously the supply was equal to 46 days. By turning off the water at night, a saving of four million gallons per day has been effected. Last Friday, Sir John Harwood again appealed to the consumers to exercise every economy. The rainfall in the early part of last week had practically no effect on the Bradford water supply. At the high-level, the rain was so slight that no increase in the contents of the reservoir resulted. At the low-level, the supply was increased by 5 million gallons—about a day's present consumption on that level. A heavier and more constant fall of rain will be required before the Corporation will be justified in ceasing to restrict the supply. It is reported from Newcastle that the quantity of water in store on the 30th ult. was 1521 million gallons, as compared with 3023 millions on the corresponding date of last year. The Llanelly Local Board have found it necessary to give their Surveyor instructions to make arrangements to obtain a temporary supply of water from the Gors Colliery, at an estimated cost of £500.

MISCELLANEOUS NEWS.

THE METROPOLITAN WATER SUPPLY COMMISSION.

(*Lord* BALFOUR OF BURLEIGH, *Chairman; Sir* G. B. BRUCE, *Sir* A. GEIKIE, *Professor* DEWAR, *Dr.* OGLE, *Mr.* G. H. HILL, *and Mr.* J. MANSERGH, *Commissioners.*)

Thirty-second Day—Friday, June 30.

The final sitting of the Commissioners took place to-day. Its object was to allow Dr. Barry, one of the Medical Inspectors to the Local Government Board, who conducted the inquiry into the cause of the outbreak, in the autumn of 1890 and the spring of 1891, of enteric fever in the Tees Valley, to which several witnesses, particularly one or two on behalf of the London County Council, had referred, to give evidence on the subject. Mr. D. D. Wilson, the General Manager of the Stockton and Middlesbrough Water Board, at the previous sitting, attributed the epidemic to insanitary circumstances and conditions—thus contesting the conclusions arrived at by Dr. Barry in an interim report made by him.

Dr. *Barry* explained that it was his duty to conduct constantly such investigations as the one at Stockton; and he had been engaged on many, though not on so large a scale, as regarded enteric fever, as the Tees inquiry. He was aware of Mr. Wilson's contentions; and, being at once afforded by the Chairman an opportunity of making any statement he desired, before being questioned by the Commissioners, he said the only preliminary remark he would make was that he regarded his final report as establishing the strongest possible presumption, short of actual proof—as complete demonstration as there could be, in the present state of medical and scientific knowledge—that the Tees water, as distributed by the Darlington and the Stockton and Middlesbrough Water-Works, was, in the attack of 1890-91, the cause of exceptional prevalence and mortality from enteric fever in districts using the water. Mr. Wilson claimed that he had brought forward considerations sufficient to satisfy anyone that, whatever was the cause of the epidemic, it was not the water taken from the river during the floods of August and December, 1890. In his (Dr. Barry's) view, Mr. Wilson had done nothing of the kind. That gentleman's contentions were based on evidence of a negative class, and concerned, for the most part, the fringe only of the great body of facts with which he (witness) had dealt in his final report. If the Commission thought his deductions were invalidated, he would have to ask to be allowed to comment in detail on Mr. Wilson's evidence, and to have some days to marshal his facts in; but if his main conclusions were not called in question, he was prepared to note some mistakes and misstatements of Mr. Wilson.

The CHAIRMAN remarked that it was impossible for the Commission to say what conclusions they had come to, whether or not the witness's deductions were borne out by the facts he had marshalled. They had carefully avoided discussion until they heard what he had to say, and, further, he stated for his colleagues that they could not hold any further sitting after that day. They would be obliged to report immediately; and they must leave it to the witness, in his discretion, to make any comments he chose. On the other hand, he pointed out that it was the main general conclusions that the Commission would chiefly consider.

Witness expressed himself quite prepared to advance on the general question; but he asked for permission to correct some errors in the proof submitted of his final report on the Tees Valley outbreak. In the course of his doing so, he directed attention to the remark he had made about the uniform distribution of the attack.

The CHAIRMAN (interposing) said he understood the witness did not adhere to the statement of uniformity, only to that of universality, although in his interim report he laid great stress on uniformity, as Mr. Wilson had pointed out.

Witness said he did not put great stress on the point, and explained that there was not absolute uniformity. There was universality of attack, and there was uniformity of incidence.

But tell me whether, on the point of uniformity, your investigations subsequent to the publication of the interim report, have or have not modified your statements on the point of uniformity?—Not in the least, so far as uniformity of exceptional incidence goes. I have perhaps used an unfortunate term; it may have been misunderstood.

Then what does the correction imply if not a change of opinion about uniformity?—There is no change of opinion on my part. There was a uniform excess of incidence of disease; that is the point.

If it was uniformity of excess, why change it for universality?—Because it has been misunderstood. It has apparently been understood that there was a mathematical uniformity.

And you did not mean that in the interim report?—No, not in either report.

Asked what, in his opinion, it was essential to prove in order to lay the blame of an outbreak of fever upon a water supply, witness referred to the incidence of the attack on the drinkers of the water as compared with the non-drinkers, and proceeded to point out that in the Tees case, putting aside two or three instances where the numbers of persons involved were so small as to give unreliable rates, it was demonstrated that the exceptional incidence of the enteric fever was practically confined to the users of Tees water.

There again is a limitation, perfectly fair from the circumstances brought to your notice. Still, you cannot say it is proved to demonstration; it only amounts to "practically"—In my opening statements I said we could not, in our present state of knowledge, do more than establish a presumption—a complete demonstration being impossible.

There is no summary set forth in your report of what it is necessary to prove before you lay the blame of any particular outbreak or spread of disease on a water supply. But you have said quite fairly that, when you attribute an outbreak to water, it should be shown that the disease was confined to the users of that water?—With the exception of exceptional incidence.

The exceptional incidence would also have to be practically simultaneous in its outbreak?—Quite so.

Would not the outbreak, in your opinion, have also to be practically uniform among the consumers of the water? I am using the word "uniform" in the sense in which I certainly thought you used it in your interim report. I do not mean to say mathematically uniform, but nearly uniform?—Nearly uniform. There may be particular circumstances in the water area by which large districts might escape.

Why, if they drink the water?—The particles of enteric fever are not diffused equally, we believe, throughout the medium by which it is disseminated. Consequently, you might perfectly well have in certain districts a large quantity of the particles distributed, while others escaped them altogether. That is quite possible; and it has been noticed over and over again in our inquiries.

Can you give me a corresponding instance off-hand?—I am afraid I cannot.

You see, it comes so much to be a question of degree. I can quite understand a household, with the amount of drinking water they use, escaping; but I cannot understand a body of 150, or even 100, houses using the water, and not having a case among them. You agree with me that it is a question of degree?—Yes. But it is a question also of the amount of poison that is introduced into the disseminating agency. You may have the poison extremely diffused in water; and it would be so where there are large water-works.

Would it not be equally diffused in the case of Stockton and Middlesbrough, where the water is pumped from a common source and filtered in a uniform way, mixed in storeage reservoirs for a certain time, and then distributed over the whole district uniformly?—It would be very much diffused in that case; and that is all the more reason for certain houses escaping it.

Supposing California, with 150 houses, or other places with 50 or 60, absolutely escaped—assuming that—does it or does it not, in your opinion and experience, raise any presumption whatever that the cause of the disease has not been uniform, or break down the idea that it has been—that uniformity has not been established?—I have already said that you may not have uniformity where you are dealing with a particular infection; and the escape of 100 or 500 houses in a large area would not, in my view, at all affect my conclusion.

Very well. Then another condition—as you will agree, a condition precedent to attributing fever to a specific cause—would be that there would be nothing else to account for it?—Quite so; no other common cause.

Over the districts which are infected?—Over the districts invaded.

Attention having been directed to the tabular statements of the witness respecting the Tees outbreak, and the Chairman having spoken of startling disproportions between the figures of deaths and cases in different districts, and suggested that these disproportions might raise a presumption of an underlying fallacy, witness allowed that they might get a fallacy to some extent in comparing the figures for one district with those for another. In certain districts they had better returns than in others.

The CHAIRMAN explained that the presumption raised in his mind by the disproportions was that the ratio of deaths to cases was in the water districts larger than it ought to be, and in the non-water districts smaller than it ought to be; and that a strong presumption was raised in his mind that witness had had returned to him for the water districts more cases than really occurred, and for the non-water districts fewer than there were.

Witness said he thought there might be something in the contention.

Statistics having been quoted in support of this,

The CHAIRMAN asked if the witness did not think there was confirmation of the point uppermost in his Lordship's mind—that in the notification districts they had statistics which were fallacious in one direction, and in the non-notification districts statistics which were fallacious in the other.

Witness said he thought he acknowledged this at the commencement.

The CHAIRMAN: But it so happens in many cases, as I understand it, that the notification and the non-notification districts are largely correlative to the drinkers and the non-drinkers of Tees water.

Witness said this was not so; and he proceeded, by reference to his statistics, to justify this reply and his general conclusions. He admitted that his figures, as between the drinkers and the non-drinkers, were to some extent fallacious.

Examined by Professor DEWAR, witness said he remembered that Dr. Frankland, in the year 1870, made an analysis of the Stockton water supply, and that, after describing the borough and the Stockton and Middlesbrough Water-Works, the mode of taking water from the Tees, and the chances of pollution of the Upper Tees, and recognizing that the river was polluted with sewage from several villages and refuse from works, he said the water supplied for consumption at the time his sample was taken was of unimpeachable quality—as clear and bright, and nearly as palatable, as deep-well or spring water. Witness thought there was no substantial difference between the composition of the water in 1870 and at the present time. As a matter of fact, it was not from the ordinary state of the Tees that he looked for danger to the communities drinking the water taken from it; it was to the unusual condition of the river (such as after floods) that he attached importance in the matter of fever outbreaks. At the same time, when fever had spread abroad, in the water supply area, for some reason or other, it was quite possible that it spread in certain districts, owing to insanitary conditions.

After a short adjournment,

Witness requested and received permission to read a report, not previously made public, which he presented to the Medical Officer of the Local Government Board in June, 1890, with reference to a prevalence of enteric fever in the Tees Valley, and which he regarded as supporting his present conclusions. In it he stated that he had, in accordance with instructions, visited the urban districts of South Stockton and Stockton-upon-Tees, and found that there had been an unusual prevalence of enteric fever in both districts from September, 1889, to March, 1890; that exceptional fever prevalence had not by any means been confined to the two Stocktons, but had extended over a very large area adjacent; and that the one conspicuous condition common to the whole of the large infected district was the water supply, furnished from the Stockton and Middlesbrough Water-Works, the water of which is obtained from the River Tees above Darlington. The report also stated that in Darlington enteric fever had been exceptionally prevalent during the autumn and winter months, and this district likewise obtained its water supply from the Tees; and, further, the writer (Dr. Barry) could not hear of any unusual prevalence of fever in neighbouring districts outside the area supplied with Tees water. "The drainage area of the River Tees, above the intakes of the water-works referred to, is 212,000 acres, having a population of 21,000 persons, of whom 12,000 live close to the river. The sewage from all the villages on the Tees above the intakes passes into the river without treatment. When, after a period of drought, the river is in flood, the water is stated to be very foul, and, as a rule, on such occasions, it is stated that no water is taken from the river for water-supply purposes until the flood water has passed."

At the close of this witness's evidence,

The CHAIRMAN said this absolutely concluded the inquiry; and they should do their best to report before separating for the holidays.

THE REDUCTION IN THE ILLUMINATING POWER OF THE GAS AT LEEDS.

At the Meeting of the Leeds City Council on Wednesday last—the MAYOR (Mr. Alderman Ward) presiding—the following resolution was under consideration: "That the resolution passed by the Council on the 8th of February, 1888, approving the proceedings of the Gas Committee, be rescinded, so far as the same relates to the illuminating power of the gas being kept up to a standard of 19½ candles, and that the following resolution passed by the Gas Committee on the 30th of May, 1893, be approved: 'That, subject to the approval of the Council, instructions be given to the Managers to produce gas of the illuminating power of 18½ candles, and that the minimum shall not be below 18 candles.'"

Alderman GILSTON, the Chairman of the Gas Committee, in moving the adoption of the resolution, said that for a long time past the Gas Committee had found themselves with a deficit balance. As they had recouped themselves, and obtained a small balance on the right side, something had turned up which had increased the cost of the article they had to produce, or lessened the value of the article they had to sell, and in this way they had been thrown back. At the present time they had a deficit balance against them of £30,718. This had been accumulating since the year 1885. But while they had incurred this balance against the gas undertaking, they had during that time paid into the sinking fund £79,503 from revenue; so that, as far as the Corporation and the ratepayers were concerned, they had ample guarantee even for a deficit of £30,000. The Committee considered that the time had come when some steps should be taken for the purpose of getting rid of this deficit, which was costing them about £1200 a year for interest. They were of opinion that there were only two or three ways by which the matter could be remedied. It could be easily done by increasing the price of gas; or they could lessen the illuminating power; or they might try to find a better mode of managing the works. He was opposed to increasing the price of gas, because it was becoming an article of consumption not merely for the purpose of illumination, but for motive power, and cooking and heating purposes. They had something like 500 gas-engines at work in the various industries of the city, and 1500 cooking-stoves; and 18-candle gas would do as well for them as 19-candle. There were also a great many gas-fires. This being the case, the Committee had come to the conclusion that the best way to meet the deficit was to ask the Council to reduce the illuminating power from 19½ to 18½ candles; and by this means they would be able to lessen the cost of production. He had previously told the Council that in October last they determined to try an experiment by reducing the quantity of cannel used. They could purchase ordinary coal at about 10s. per ton on the average; while cannel cost them from 19s. to 19s. 6d. per ton. In the six months during which they had tried the experiment, they found that they had a profit on the year of £13,000; and, after taking from that £10,000 for the sinking fund, it left them £3000 for the reduction of their debt. The cost to increase the illuminating power from 18 to 19 candles was variously estimated at from 3d. to 4¼d. per 1000 cubic feet. During the half year that they had tried the experiment, at the Meadow Lane works the coal, which would have cost them 12s. 4d. per ton with cannel, had cost them 10s. 10d.; at the New Wortley works the coal, which would have cost them 12s. 0¾d., had cost them 10s. 11d.; and at the York Street works the coal, which would have cost 12s. 10d., had cost 11s. 6d. There was thus a saving of £10,929 10s. in the six months. With 19 or 19½ candle gas, condensation took place to a rapid extent. The result had been that, since they discontinued using this large quantity of cannel, they had saved in leakage more than 2 per cent.; and this represented between £5000 and £6000. During the nine months that they had been producing gas of this quality, there had only been nine complaints of inferior illumination. If they ceased to buy this costly coal, and adopted 18½-candle, instead of 19-candle power, the Committee believed they would be able to meet the wishes of the whole of the users of gas without increasing its price. In the time he was speaking of, the illuminating power of the gas at the works had averaged 18·4 candles. Mr. Buckley's tests, during the whole of that time, averaged 18·25 candles. It might be inquired how it was that, after all this time, they had come to the Council and asked that the illuminating power of the gas should be decreased. He thought they might ask: Had there not been development in the gas-works? Had they not made a larger quantity than in former years? Yes; they had done that. They had been getting 51 per cent. more out of every retort than they did when they had one Manager; and the consequence was that, whereas in 1885 it required £7 in expended capital to carbonize a ton of coal, it now cost the Corporation £4 14s. They might wish to know how it was that they could not recuperate themselves from the increased supply. They were paying 10d. per ton more for labour alone than they paid in 1885; and this was an increase of £10,458. Then they had paid £39,741 more for coals than they would have had to pay if

they had been able to purchase at the prices of 1885. They had paid more for meter repairing; and, in accordance with the requirements of the Finance Committee, the discount had been increased to 5 per cent., instead of 2½ per cent. They were now obtaining from residual products £27,181 less than they did at that time; so that altogether they were receiving £83,380 less. These were the things they had been contending against, in the hope that the prices of tar and ammonia would rise. They were realizing 23s. a ton for tar now; and the prospect was that, when they entered into the contract next year, they would not get half that amount. He thought the Council would see from this that the Gas Committee had been battling against no ordinary difficulties. They had tried to work themselves round by the usual means, and found they could not; and they were determined now that the Council should give them the power to use a less quantity of cannel, or that the price of the gas should be increased, so that they might get out of debt. The reduction in the illuminating power had only been about ¾ candle; and they did not propose to reduce it lower than that. The question might be raised about superior management, He was glad to say they were acting upon lines that all successful Corporations were beginning to follow. They had three Managers; and Manchester and Bristol had followed their example. Birmingham had two Managers; and the South Metropolitan Company had a Manager at each of their stations. He believed that in Leeds they had three men, any one of whom was quite capable of managing any gas undertaking in the whole country; and their works were well managed. He could prove this from the fact that they were getting 51 per cent. more gas from each retort than they did in the year 1885; the sulphur had been reduced from 22 to 15 grains; and they were now producing 680 cubic feet more gas per ton of coal. The cost of management was less; and they were obtaining better results than before. He had no desire himself that they should go back and place the whole responsibility of that great undertaking in the hands of any one man.

Mr. Laycock, in seconding the resolution, said they could save something like £16,000 a year by the proposed alteration, and not only that, but they would encourage manufacturers to come to the city by giving them gas at 2s. 2d. They had as good gas in Leeds as they had in any other town.

Mr. Tweedale considered the resolution was a retrograde one. During the six months that they had been conducting this so-called experiment, they had been supplying gas of less illuminating power than they were compelled to do. Their average had ranged during the six months from 18·3 to 18·5 candles; but the parliamentary standard was 18·7 candles. He hoped the Council and the ratepayers would not be frightened by this cry of dear gas, because it was a fallacious cry. The richer the gas they made, the less consumers would have to burn; and they would make a saving in that direction. He maintained that, if they had had a Manager, they might have had a considerably larger increase than 51 per cent. in the production per mouthpiece. They had to bear in mind that over and above their three Managers, they had a Committee of amateurs. He trusted they would put their gas undertaking in a more satisfactory condition than it had been for years past, and pay a salary to a competent man to bring them out of the quagmire in which they had been for years. He hoped the resolution would be rejected.

Aldermann Scarr regretted that the Committee had not taken "the bull by the horns," and gone in for 17-candle gas. However, they had taken a step in the right direction.

Mr. Lowden moved an amendment (which he had proposed in Committee) to the effect that the minimum illuminating power should be 18½ candles, with a direction to their Managers to make 19-candle gas if possible. He held that it was not necessary to reduce the gas to 18-candle power; and if they did, it would be an injustice to the consumers. He had had tests made, which showed that it required 60 minutes for 5 feet of gas of 19-candle power to pass through a meter; when the gas was of 18½-candle power, 5 feet passed through in 55 minutes: and with gas of 18-candle power, 5 feet passed through in 50 minutes, so that what they were really asking for was an advance in price. It was a positive fact that, if the resolution was carried, every individual, instead of paying 2s. 2d. per 1000 cubic feet, would pay 2s. 7d., so that the Committee were practically asking for an advance of 5d. per 1000 cubic feet. He found from the reports submitted to them by the Managers of the works that they estimated, on the same lines as they had done during the last six months, that there would be £16,500 profit for the next twelve months; but he fancied they might add to that very materially. He believed Alderman Gilston was expecting a very considerable reduction in the price of coal, and that the contracts would be from 1s. to 1s. 3d. per on less than those of last year. Taking the figure at 1s., it would realize £17,565; and adding this to the amount they estimated would be the profit for the present year on the basis of last year, they had a profit of £34,065 for the ensuing year. He did not think the ratepayers should be called upon to wipe off, in one or two years, this large deficit. He had reason to believe that their Managers could produce 18½-candle gas with no more expense than at present, if they were allowed to use inferior cannel coal, which cost about 13s. 6d.

Mr. Denton, in seconding the amendment, said that during the time they had been selling 18-candle gas, they had had a very large increase in the consumption as compared with the previous year; but when they were selling 19-candle gas, the consumption was nearly stationary.

Mr. Harland had been startled to find that, as the quality of the gas was reduced, his bills had increased.

Alderman Henry pointed out that the Committee's deficit accumulated during the period when the gas was sold at 1s. 10d. per 1000 cubic feet; and at the time the price was increased by 4d., he said it was not sufficient, and that it should have been raised 6d. With regard to the tests quoted by Mr. Lowden, he should like the name of his authority.

Mr. Lowden said his authority was an eminent professional gas manager; and he was willing to submit his name to the Mayor.

Alderman Henry (continuing) said that before they could give due weight to that statement, they must have the authority. It was a serious statement that 18-candle gas would cost more than 19-candle. Twopence per 1000 cubic feet would have brought in from £16,000 to £17,000 a year; and if they had had this during the last four or five years, there would have been no deficit whatever. If they charged the prices that Manchester or Liverpool or Birmingham did, they could have made a profit of £40,000 or £50,000 per annum, which might have gone into the borough fund; but the instructions of the Council were to manage the concern so that they should neither make loss nor profit. He should support the resolution.

Mr. Willey said he had seen the name of Mr. Lowden's authority; and it was that of one of the most eminent gas engineers in Yorkshire. In his (the speaker's) opinion, the deficit had solely arisen through bad management.

Alderman Baker confessed that he could not discern the difference between the gas now and what it was a year ago. As to the management of the gas-works, he hoped they would never go back to the one-man system of years ago. He would vote for the resolution.

Mr. Leuty said they could account for the deficit by the fall in the price of the residual products; and they could show that the three Managers had produced better results than were obtained under one Manager. With regard to the increased production, however, he pointed out that the smaller retorts had been replaced by larger ones as they required renewal.

Alderman Gilston, in reply, observed that Mr. Lowden would not give the name of his authority. He dared not trust his reputation to the statement, because it was not correct. With 19-candle gas, 5 feet could not be burned in sixty minutes; so that it was no use trying to argue upon a matter which could not be done. The average consumption of Leeds gas per hour when it had averaged 19 candles had never exceeded 4·6 feet; and as to the romance about their gas costing 2s. 7d. instead of 2s. 2d., he did not know where he had been getting his figures from.

The amendment was then negatived; and the resolution was carried by 35 votes against 14

THE PUBLIC LIGHTING OF GRIMSBY.

A Stubborn Lighting Committee and Discontented Ratepayers.

Some weeks ago, the Lighting Committee of the Grimsby Corporation decided, with the view, it seems, of decreasing the expense of the public lighting and of punishing the Gas Company, to dispense with the street lamps until the 1st prox. The action of the Committee gave rise to much adverse criticism; and the public feeling found expression in the Town Council. At the meeting of this body on the 26th ult., Mr. Connell explained that the curtailment in the supply of gas was agreed to on purpose simply to economize the public money. The Gas Company would not meet the Committee—even seeing that they paid such a large amount; and people ought to look a little beyond the Corporation, and observe the original cause of the difficulty. Mr. Grainger moved that the Committee be called together at the earliest possible moment, as there was a great deal of dissatisfaction and complaint at the town being left in darkness during the nights of the summer months. Mr. Maddock, in seconding the motion, advised the Committee to use oil-lamps; and a member suggested tallow candles. Mr. Barker defended the Gas Company, who, he said, were getting very little out of the public lighting transaction. They provided the lamps, and cleaned them—which required 18 men in constant employment—lighted the lamps (this always occupied nine men), and supplied the gas. They had to consider the outlying stretches of streets, which all made more labour. He ventured to say the Company compared favourably in their transactions with the Corporation with other gas companies in the provinces. He should like to see the Corporation light the lamps in the future. The Mayor (Mr. Alderman Doughty) supported Mr. Connell in his explanations; but said it seemed that the Committee had cut the matter rather too fine.

The Lighting Committee had a meeting on the following Wednesday, when the Chairman (Mr. Alderman Palmer) stated that the matter of the discontinuance of the public lighting had been brought before the members for them to decide what should be done, in view of the complaint which had arisen. It was pointed out that the gas-lamps would be re-lit on the 1st of August, if the arrangements previously made were not altered; and that one of the two months in which they should not be lit had already expired. Mr. Curry proposed that the lamps should be re-lighted at once. He said it was a positive disgrace, on going into the streets on the previous Saturday night, to find that there were no gas-lamps lighted. The streets were pitch dark. Mr. Connell said it seemed the public were not aware of the reasons which had driven the Corporation to adopt the course they had taken. The Committee were most anxious to keep down the expenses to the amount certified in the agreement with the Company —all gas being charged as extra; and, as the Company would not meet them, the Corporation had been forced, on lines of economy, to take the step they had. He proposed, as an amendment, that they keep to the lighting table which specified that the lamps were to be re-lighted on the 1st of August. He thought they would then have done something to bring the Company to their terms. They would alter the plan another year; but, if they "threw up the sponge" now, it would be doubtful whether they would make any impression on the Company. Several speakers supported the amendment; and it was eventually carried by a large majority The Committee have consequently decided to pursue what a local paper calls their "lunatic policy," and leave the streets unlighted for another three weeks. Subsequently, the Chairman read the gas tenders for the ensuing year. The Grimsby Company's tender was for £2 12s. 6d. per lamp for 3000 hours. In answer to a deputation, they said that, if the Corporation required all the lamps to be lighted and burning within an hour of the lamplighters going out, an extra charge of 5s. per lamp would be made. The Cleethorpes Company's tender was £3 2s. 6d. per lamp in Weelsby and New Clee, for not less than 3000 hours; and in Old Clee, £1 10s. per 700 hours. Any alteration in the present condition of the hours of lighting would incur an additional expense of 3s. per lamp. The tenders were allowed to stand over until another meeting. The advisability of illuminating the town by electricity was suggested; and ultimately it was decided that the Lighting Committee should discuss the matter, and that the Borough Surveyor should get out estimates.

MANCHESTER CORPORATION GAS-WORKS.

Abstract of the Annual Accounts to March 31, 1893.

The following are some of the principal figures in the accounts of the Gas Committee of the Manchester Corporation, which, as signed by the Superintendent of the Gas Department (Mr. C. Nickson), accompany the report referred to in the JOURNAL last week:—

PROFIT AND LOSS ACCOUNT.

EXPENDITURE.	Dr.
Cannel and coal (including cost of unloading, &c.)	£248,718 8 3
Retort men's wages	48,606 11 10
Retorts, fire-bricks, &c. (including cost of setting)	15,332 2 10
Repairs and maintenance of works, mains, &c.	50,541 6 11
Purifying material and wages	4,621 19 11
Salaries and wages of clerks in Superintendent's office, rental and inquiry offices, and meter inspectors	16,114 13 5
Collectors' salaries	7,255 11 10
Rents, rates, and taxes	22,188 8 10
Renewals of plant, &c.	18,845 10 10
Bad debts	706 1 7
Miscellaneous expenses	3 928 0 11
Lighting repairing, and maintaining city lamps	14,039 11 11
	£450,898 9 1
Balance carried forward	104,666 3 6
	£555,564 12 7
Interest	£25,919 4 2
Sinking fund	13,954 0 0
Balance carried down	64,792 19 4
	£104,666 3 6

INCOME.	Cr.		
Gas-rental			£412,372 13 0
Meter-rents			12,527 13 9
Stove-hire			1,663 15 0
Total cost of street lighting paid out of city fund—			
Value of gas	£28,788 13 4		
Lighting, repair, and maintenance	14,039 11 11		
		42,828 5 3	
Public lamps beyond the city			4,553 7 9
Residual products—			
Coke	£37,408 10 5		
Tar	21,122 5 10		
Ammonia water	23,375 2 0		
		81,905 18 3	
Rents of cottages, &c.			312 19 7
			£555,564 12 7

The balance of profit was applied as follows:—	
Amount paid over to the city fund account	£46,046 0 0
Balance placed to contingent fund account for extraordinary renewals of plant	18,746 19 4
	£64,792 19 4

STATEMENT OF ASSETS AND LIABILITIES.

ASSETS.	
Gaythorn station—land, buildings, and apparatus	£217,041 12 11
Rochdale Road station	265,514 19 5
Bradford Road station	438,050 15 4
Droylsden station	21,179 12 11
Street-mains stores (Poland Street)—land, buildings, and apparatus	2,961 8 10
Street-mains	378,672 18 1
Service-pipes	62,844 3 7
Hired meters	82,739 17 1
Hired stoves	8,233 8 9
Cottage property purchase-money	1,652 13 6
Total property	£1,478,891 10 5
Cannel, coal, retorts, and other material in stock	98,137 1 2
City fund, for street lighting, less £42.444 9s. 6d. received on account	383 15 9
Gas-rents and other accounts due to the Committee	153,785 6 2
Cash in hand	4,616 12 5
Total property and assets	£1,735,814 5 11

LIABILITIES.			
Mortgage debt			£668,252 0 0
Sums advanced (not secured by mortgage)			1,130 0 0
Accounts owing for coal, &c.			44,668 7 7
Deposits held in security of gas-rents			36,514 19 8
Interest due thereon			4,747 1 11
Cash deposits for due performance of contracts			5,050 0 0
Amount payable on account of cottage property			1,600 0 0
Amount owing to bankers			75,645 3 8
Total liabilities			£837,907 12 10
Surplus and sinking fund, as per last statement	£844,340 10 0		
Transferred from profit and loss account for the year ended March 31, 1893	13,954 0 0		
		858,294 10 0	
Contingent fund account—			
Amount as on March 31, 1892	£20,865 3 9		
Do. transferred from profit and loss account this year	18,746 19 4		
		39,612 3 1	
		£1,735,814 5 11	

GENERAL SUMMARY OF THE CAPITAL AND REVENUE ACCOUNTS.

RECEIPTS.	
Balance brought forward (see summary March 31, 1892)	£143,747 18 3
Amount received on sale of clay, &c., at Bradford Road	80 6
Electric lighting capital expenditure (as per last balance-sheet) transferred	1,481 7 8
Sinking fund, transferred from profit and loss account	13,954 0 0
Balance of profit and loss account (as per statement)	64,792 19 4
	£224,056 11 3

EXPENDITURE.		
Loans repaid		£13,330 0 0
Amount paid over to the city fund account out of the year's profits		46,046 0 0
Expenditure charged to capital account		75,983 8 7
Stocks on hand	£98,137 1 2	
Gas-rents, &c., due	154,169 1 11	
Cash in hand	4,616 12 5	
	£256,922 15 6	
Less accounts owing to sundry creditors	168,225 12 10	
		88,697 2 8
		£224,056 11 3

The accounts proper are followed by the usual appendices, giving some interesting statistics as to the progress of the gas undertaking during the past municipal year.

The figures in Appendix A—a statement of the lamp and private rental, including meter and stove rents, derived from within and beyond the city—have already been given when dealing with the profit and loss account.

Appendix B is a comparative statement of the gas transmitted from the works in the daytime and during the twenty-four hours, for the past two years. Summarized, the figures are as follows:—

	Daytime. Cubic Feet.	Twenty-four Hours. Cubic Feet.
Year ended March 31, 1892	883,190,000	3,404,678,000
Do. do. 1893	940,454,000	3,634,690,000
Increase	57,264,000	230,012,000

	Cubic Feet.
Quantity of gas transmitted from works	3,634,690,000
" measured and accounted for	3,503,960,000
Loss (by condensation and leakage)	130,730,000, or 3·6 per cent.

In Appendix C, particulars are given as to the results of the working from June 24, 1880, to March 31, 1893. The table contains statistics as to the number of tons of coal carbonized, the total make of gas, the yield per ton of coal, the illuminating power of the gas, the quantity of residual products, &c., for each year in the above-mentioned period. The particulars for the past financial year are as follows: Coal and cannel carbonized, 365,235 tons; gas made, 3,636,680,000 cubic feet; yield per ton of coal carbonized, 9957 cubic feet; illuminating power, 19·11 candles; make, reduced to 20-candle power, 3,474,847,000 cubic feet; make per ton, 20-candle power, 9514 cubic feet; make of coke, 229,695 tons; do. per ton of coal, 12·58 cwt.; make of tar, 24,500 tons; do. per ton of coal, 13·08 gallons; make of ammoniacal liquor, 9,247,054 gallons; do. per ton of coal, 25·32 gallons; make at 10-oz. strength, 9,259,268 gallons; do. per ton of coal, 25·35 gallons.

Appendix D shows the number of stoves and of each size of meter in use during the year in the city and out-townships. At the close of the past financial year, there were 4070 stoves in use within, and 1232 beyond the city—together, 5302. Of these, 2005 were on hire within, and 647 beyond the city (together, 2652), as compared with 1983 and 585 (together 2568) at the corresponding date in 1892; so that there was an increase of 84. The numbers of the meters in use were 81,433 in 1893 and 80,571 in 1892. There was last year a net increase of 862 on the number for the preceding year. Of the total number at work on March 31 last, 71,148 were on hire, as compared with 69,949 at the close of the financial year 1891-92. The number of prepayment meters on hire on March 31 last was 209.

From Appendix E we learn that the gas-mains laid last year within the city amounted to 24,164 yards, and beyond the city to 11,461 yards—a total of 35,625 yards, or about 20¼ miles. The mains taken up were 8939 and 3418 yards respectively—a total of 12,357 yards, or 7 miles 37 yards. The total net increase during the year therefore was 23,268 yards, or 13 miles 388 yards. The total length of mains laid at March 31 last was 1,240,324 yards, or nearly 704⅜ miles.

Appendix F consists of a statement showing the amount of gross profit made from the gas undertaking, and the mode of its appropriation, also the amount of borrowed money owing, excess of assets, &c., from 1862 to March last. The figures for the past financial year are as follows: Profit, £104,666; paid over for improvement purposes, £46,046; placed to renewals account, £18,746; borrowed money owing, £669,682; and excess of assets, £897,906. The profit of £104,666 is appropriated thus: Interest, 25,919; liquidation of mortgage debt, £13, 954—leaving a surplus of £64,793.

The Electric Light Installation; The Working of the Gas Undertaking.

On the proceedings of the Gas Committee being presented at last Wednesday's meeting of the City Council,

Sir J. HARWOOD remarked that one of the works of which he should be glad to be relieved was coming to a close. For many years he had had to do with the Bill which enabled the Corporation to deal with all companies who wanted to establish electric lighting stations in Manchester; and finally they obtained parliamentary powers to put down an installation themselves. He had been Chairman of the Committee which dealt with the matter; and he was happy to say that, all being well, in about ten days' time they would be able to light the Gas Offices in the Town Hall with electricity, and he was confident that the whole of the building would be so lighted during the autumn. For reasons which it would not now be prudent to state, the Committee had been prevented from going on with the work in the Town Hall in

the way they would very much have desired; but they were doing the best they could. He desired particularly to congratulate the Council upon having succeeded in putting down an installation second to none in the kingdom, and perhaps second to none in the world. They would be able in about a fortnight or three weeks to begin supplying electricity over a very large part of the city. Many public buildings would, it was understood, be lighted by that agent. The Committee were very much pleased with the efficient way in which the work had been carried out. They intended to supply electricity in the streets precisely in the same way, and to the same extent, as they supplied gas to-day. The only exception was in the matter of meters, which the Committee would provide. But with regard to these meters, he unhesitatingly said that they were very expensive and unsatisfactory, and at any day they might be superseded by something that was satisfactory. They hoped the day was near when the scientific men who were trying to find a meter that would be much more reliable than those now in use would be successful.

Mr. J. Brooks formally moved the adoption of the proceedings of the Committee.

Alderman Lloyd, in seconding the motion, congratulated the Committee upon having had a fairly prosperous year, and that they were able to look forward to a good balance. With reference to the residual products, he found that the quantity of ammoniacal liquor obtained per ton of coal and cannel carbonized amounted to 25·35 per cent.; he believed the average quantity was 28 per cent. He learned from the Chairman of the Committee that it was intended ere long to make experiments in the direction of utilizing the ammoniacal liquor by converting it into sulphate of ammonia.

The motion was agreed to.

THE GENEVA MUNICIPALITY AND THE GAS-WORKS.

Some time ago, the Municipality of Geneva, having in view the acquisition of the undertaking of the Geneva Gas Company, procured the assistance of three experts (MM. Rothenbach, Bouvier, and de Meuron) to determine its value. Their report recently came before the Municipal Council; and from the abstract which appeared in the *Journal de Genève*, we take the following particulars: The maximum daily output of gas from the works is 24,380 cubic metres, or about 860,000 cubic feet; and for the entire year, it has reached a total of 5,500,000 cubic metres, or 194,150,000 cubic feet. The experts considered it would be necessary to enlarge the works at an early date; but, on the whole, their opinion upon them was favourable. The works stand on ground having a superficial area of 27,997·55 square metres; and its value is put at 643,943 frs., or about 23 frs. per square metre. There is an adjoining piece of land, reserved for extensions. Its area is 5278·20 square metres; and it is reckoned to be worth 110,843 frs., or about 21 frs. per square metre. The total value of the ground is therefore put by the experts at 754,780 frs.; the Company's estimate being upwards of 1,500,000 frs. The price of the works and plant is fixed at 902,500 frs.; that of the mains and public lamps, at 784,316 frs. In the event of the Municipality taking possession of the property at once, the purchase price is given as 2,441,602 frs., or 2,330,760 frs. without the additional land. Supposing the Municipality wait till the end of the Company's concession (in 1895) before purchasing, the experts fix a sinking fund of 3½ per cent. upon 1,686,816 frs., exclusive of the value of the land. The annual payments into this fund up to the above-mentioned date would therefore be 53,978 frs. If the purchase took effect as from April 1 in the present year, the price at the end of the concession would be 2,297,977 frs. including the additional land, and 2,182,135 frs. without it. Not knowing when their decision would take effect, the experts gave these figures by way of illustration. The report contains a number of stipulations as to the manner in which the amortization of the new mains and plant is to be effected until the acquisition of the undertaking by the City. The rate is to vary from 2 to 7 per cent., exclusive of the 5 per cent. interest on the capital employed. When the report was under consideration by the Council, an opinion was expressed that there was little probability of the City being called upon to purchase the gas-works before the end of the Company's concession. With regard to the financial part of the question, prominence was given to the fact that the price named by the experts came very near the estimates of the Administrative Council, who contemplated an expenditure of 3,000,000 frs. for the acquisition of the works and effecting the necessary improvements. A few days after this matter was before the Municipality, the Gas Company held their annual general meeting. The report presented by the Directors showed, among other things, a remarkable increase in the consumption of gas for industrial purposes. The returns were most satisfactory; and they allowed of the payment of a dividend of 60 frs. per share. The report of the experts, of which a summary is given above, was read; and it was explained that their estimate as to the worth of the Company's property brought out the actual value of the shares (100 frs. nominal) at 350 frs., without reckoning the returns for the last few years of working. Gratification was expressed at the fact that, at the end of the Company's concession, the interests of the City and of the investors in the undertaking would be well protected.

Sale of Shares.—At a sale by auction at Boston last Tuesday, some £10 shares in the *Boston Gaslight Company* realized £17 17s. 6d. and £18 each.

The Hull Corporation and the Newington Water-Works.—It is stated that negotiations are pending between the Hull Corporation Water Sub-Committee and the Directors of the Newington Water Company, with a view to the final arrangement of terms for the acquisition of the property of the latter body. This will give the Corporation complete control of the whole water area of the borough. It is expected that the purchasing price will be based upon the present earning powers of the Company. This, taking the usual terms of purchase into consideration, will amount to an annuity of something like £3800 for the term of sixty years, when the total cost of acquisition will have been discharged by the Corporation.

EASTBOURNE TOWN COUNCIL AND THE WATER-WORKS.

Proposed Compulsory Purchase.

On Oct. 3 last, the Eastbourne Town Council passed a resolution expressing their opinion that the time had arrived when the water supply should be under their control. Communications thereafter passed between the Town Clerk and the Secretary of the Company, from which it appeared that the Directors were not prepared to advise the shareholders to sell the undertaking. They contended that the Company had always fulfilled the obligations imposed upon them without any complaint, and had spared no expense in providing a constant and abundant supply of water. A long report on the subject was submitted to the Council by the Lighting and General Purposes Committee yesterday week. It stated that the Company was incorporated by an Act passed in the year 1859, and that extended powers were obtained in 1875, 1881, and 1889. The total amount of capital involved was something like £250,000; and the authorized dividends were 7 and 6 per cent. In 1887, the receipts amounted to £14,148; and in 1891, to £17,290—the sums available for dividend in those two years being £8334 and £10,063 respectively. These figures showed that very steady progress was being made from year to year. The Committee concluded their report by recommending the Council (1) to reaffirm their resolution of Oct. 3. In support of this, they pointed out that it was evident the capital of the Company was increasing by leaps and bounds; and every year added to the value of the undertaking. (2) The Committee advised the Council to authorize the promotion of a Bill in Parliament for the compulsory acquisition of the water-works. Under this recommendation, they urged that the Company would most likely agree to terms during the passage of the Bill through Parliament, and that the cost of promoting the Bill, if opposed, would not exceed £1000 or £1200. If compulsory powers were conferred on the Corporation, it would be, the Committee were informed, on terms of the Corporation paying the value as fixed by arbitration under the Lands Clauses Act; and, speaking roughly and from former precedents, the Company would not be paid more than annuities or dividend on as much stock as would replace their statutory dividends. The principal question for arbitration would be whether or not the concern had paid the maximum statutory dividends. Without suggesting that there had been any deficiency in the supply, the Committee were strongly of opinion that the water was exceedingly hard, and that steps should be taken to soften it forthwith. Again, the Committee urged that the Company were constantly interfering with the roads, and that it was desirable the opening up of the roads should be entirely in the hands of the road authority, so that it might be done at the best time and with the least inconvenience. They were also of opinion that the charges for water were excessive, and that the inhabitants should benefit from any profit derived from the supply. The Committee were at a loss to understand why the Company should object to the transfer of the works so long as they were paid a price which would realize a dividend equal to that which they were now receiving. It might, however, be reasonably anticipated that Eastbourne would maintain its past rate of progress; and there should certainly in their opinion be no further delay in the matter, otherwise the price to be paid would be considerably larger. (3) The Committee recommended the Council to authorize the Town Clerk to confer with their Parliamentary Agents with a view to the drafting of the necessary Bill for submission to the Council and the preparation of such reports as might be necessary. The recommendations of the Committee were adopted.

THE NEW WATER-WORKS FOR MORLEY.

The new water-works, which the Morley Corporation were authorized by Parliament about three years ago to carry out, are now fast approaching completion. The scheme was devised by, and is being constructed under the supervision of, Mr. Charles Gott, of Bradford. It comprises, first, a large storeage reservoir, which is being built at a place called Withens Moor, on the Blackstone Edge range of hills between Todmorden and Sowerby. Two gauge water conduits are being made to bring certain streams round the hill into the reservoir; and this will enable the Corporation to take the water from a drainage area of 1200 acres. The gathering-ground, which is a fairly good one, and contains some fine springs, runs back to an elevation of 1350 feet above sea-level at its upper edge. From the storeage reservoir is carried a line of main pipes, 15 inches in diameter, which convey the water through Sowerby, Greetland, Elland, Rastrick, Cleckheaton, Gomersal, and Birstall into the borough of Morley; the total length being 21 miles. The level of the storeage reservoir at the water-line when full is 960 feet above sea-level; and from it the water can be supplied to any part of the borough or neighbourhood by gravitation. The reservoir (which has been in course of construction since April, 1891) will contain an area of 64 acres of water; its total extent, including the embankments, side channels, and other works, being about 80 acres. The embankment of the reservoir is 834 feet in length, and 85 feet in height in the middle. Its capacity will be between 300 and 400 million gallons; and the water-level will be 60 feet above the drawing-off point, which is 10 feet from the bottom. The Corporation will have to send down as compensation water to the streams a supply of about 580,000 gallons per day; and the remainder (about 1,250,000 gallons per day) will be available for the supply of Morley. The estimated total cost of the scheme is £100,000. The storeage reservoirs will cost £40,000, the iron pipes £30,000, laying mains £10,000, and the purchase of land and easements, parliamentary, law and engineering expenses, compensation, &c., represent another £20,000. There have been many difficulties to surmount in carrying out the scheme, both in the shape of the obstacles offered by the physical conformity of the district through which it passes, and of the opposition offered by landowners and other interested parties. The main had to cross both the River Calder and the Hebble Canal—this being done by means of girders fixed to sides of existing bridges; but in other cases the pipes had to be carried underneath the streams, and frequently across railways and works of various kinds.

The original estimated cost is not likely to be exceeded to any important extent; and, when the work is completed, Morley will possess one of the most efficient and least expensive water schemes in the West Riding. It will be remembered that the project encountered considerable opposition when before Parliament; no less than seventeen petitions being presented against the Bill.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Although I have not yet received official intimation of the arrangements for the ensuing meeting of the North British Association of Gas Managers, which is to be held in Dundee on the 27th and 28th inst., I learn that the Committee will be able to put a fine programme before the members. Mr. T. D. Hall, of Montrose, is the President, from whom an excellent address may be expected. There will, of course, be the communication upon oil gas by Mr. W. Young and Mr. A. Bell, of Peebles, which these gentlemen have reserved for the meeting. Besides these, the members may expect a paper by Mr. D. M. Nelson, of Glasgow, on the Yeadon revolving retort; and, in addition, it is likely that Mr. G. Keillor, of Nairn, and Mr. D. Robertson, of Dunoon, will also read papers—one of which will be upon prepayment meters. On the second day, it is proposed to visit one of the reservoirs of the Dundee Water Commission—most probably Monikie, which is a favourite holiday resort with Dundonians, and where permanent provision is maintained for entertaining excursion parties.

An attempt was made in the Glasgow Town Council on Tuesday to draw information as to what the reduction in the price of gas is to be; Mr. Battersby asking if there was any prospect of its being reduced to 2s. 6d. per 1000 cubic feet. Mr. Ure, however, who is Convener of the Gas and Electric Lighting Committee, was not to be led into revealing before the time how much they proposed to take off the price. They generally, he said, kept that announcement for the meeting at which the Finance Convener (Mr. Mitchell) made his usual flowery speech in connection with it. There is a rumour that, on account of the favourable terms on which coal has been bought, and the large increase in the revenue, the reduction may be as much as 6d., making the price 2s. 3d. per 1000 cubic feet. It is almost useless to predict, when the Committee do not wish to divulge the amount; but one is almost safe in saying that the reduction will not amount to so much as 6d. Capital outlay has been so heavy of late, that a much larger profit must be made to meet interest and repayments than has sufficed hitherto. On the other hand, it has to be borne in mind that a great deal of the capital expenditure will lead to decreased cost of working, and that there will thus be a larger proportion of profit upon the output. When the figures for the year are published, it will be no matter for surprise if the leakage should be higher than last year. There has been a great disturbance of gas-pipes, in connection with the construction of underground railways; and this subject also was before the Council on Tuesday, in a question whether they were getting paid for the gas which was lost. To this Mr. Ure very philosophically replied that it was to be feared that no claim could be formulated, and that they must just put up with the loss; but that the railway operations might result in good, by their getting better piping laid where the old ones were lifted.

An action of some interest to gas-supplying bodies was decided by Sheriff Scott-Moncrieff, at Falkirk, this week. The Falkirk Gas Company sued Richard Glassie, a baker, for £2 1s. 7d., the balance of an account for gas consumed between Jan. 24 and April 26 last. The defence was that the debtor was the defendant's brother, William Glassie. William Glassie had failed in business, and left the place; and defender said that he, having been in his brother's employment, carried on the business for a few weeks in order to wind it up, but that he acted as his brother's servant. This defence, ingenious though it was, did not influence the Sheriff, who held, on the facts, that the defender was a principal in the business after his brother left, and in law was liable. He therefore gave decree for the amount sued for.

The extent to which gas companies and corporations in mining districts suffer from the disturbance of levels, consequent upon the working out of the minerals, is probably not appreciated in districts where there is no interference with the underlying strata. It was well told on Wednesday, by representatives of the Corporation of Motherwell, before the Select Committee of the House of Commons on Feus and Leases in Scotland, as the following passages from the evidence show. Provost Colville said that one of the sources of danger caused by the mineral workings was the breaking of the gas, drainage, and water pipes in the streets, and the consequent escape of gas and sewerage, and the pollution of the air. There was also interference with the public drainage of the town, as well as the drainage in connection with private houses. The leakage of gas, which in 1889 was 6·20 per cent. of the total gas made, reached in 1893 no less than 11·97 per cent. The increase had been so serious as to raise the cost of gas to the consumers. The Gas Company had made a claim for £540, for loss due to the mineral workings. Mr. James Burns, Town Clerk of the burgh, said there were five seams of coal under Motherwell. They were all of good quality; and their thickness rendered them all workable with profit. If all these seams were worked out, he had no doubt that every house in Motherwell would collapse. The danger of subsidence had become acute six or seven years ago. He himself had suffered. One night his house became filled with the gas from a leakage; and his wife and servant were ill from breathing the vitiated air. The escape arose from a burst outside at the junction with his house. One could not walk along the streets of the town without getting a sniff of gas now and again. Bailie James Hamilton said it was estimated that the total loss to the Corporation from damages in connection with the gas and water supply, during the last ten years was no less than £10,000. Although they had taken no active steps in the matter, the Town Council were of opinion that, wherever damage resulted from the working of the minerals, it should be made good by the Superior.

A more detailed statement of the working of the Galashiels Gas Company during the past year, shows that the output of gas was 60,464,400 cubic feet; and the quantity sold was 58,749,398 cubic feet. There was a decrease, as compared with the previous year, of 504,180 cubic feet. Decreased consumptions this season are not confined to Galashiels. The exceptionally fine weather which has been experienced since April began, has led people to spend more time in the open air than usual; and this practice has affected gas bills. Gas managers will be pleased that the decrease is taking place at the season of the year when there is least lighting; and I daresay they are living in hope that one good month in winter will place them on the right side again. The Galashiels Gas Company have the large balance in hand of £6261, of which £732 was derived from last year. The Directors reported, with reference to the oil-gas plant which they have had in use since May 23, that it has so far given every satisfaction. Since it was introduced, the usually high standard of gas supplied by the Company—29 candles—has been raised to 33 candles. In reducing the price of gas from 3s. 9d. to 3s. 6½d. per 1000 cubic feet, the Directors pointed out that, taking into account the increase in illuminating power and the extra durability of the new gas, the advantage to the consumer in using it was equal to at least three times the amount of the reduction in price. This is very true; but it will be found that many people will not be able to burn properly so rich a gas as 33-candle power. I fancy that before long the Directors will have trouble in this matter; and they will feel it to be better policy to lower the illuminating power to (say) 30 candles, and then to reduce the price. This is a step which would be more appreciated by consumers than telling them to calculate the saving they make in using a very rich gas. There is another way in which the subject may be put—namely, that much less of the high quality gas will be consumed if proper burners are used; and therefore, unless there be wasteful consumption in the community, the output for the year is bound to suffer. This is a point which those who adopt oil-gas processes will require to take into account in fixing the price of gas. It is evident, however, that one of the shareholders of the Hawick Gas Company did not do so, at the annual meeting of that Company yesterday, because the gentleman pointed out that, "although in Galashiels they were using oil, and they were nearer the coal-fields than Hawick was, yet the price of gas in Hawick was as low as it was in Galashiels." This was really talking at random; but it would go down with the shareholders, and it is certainly the way that consumers will look at the matter.

It is announced to-day that the Dalkeith Gas Company, of which Mr. A. Bell, sen., the father of Mr. A. Bell, of Peebles, is the Manager, have resolved to adopt the Peebles process of enrichment with oil, and to reduce the price of gas from 4s. 7d. to 4s. per 1000 cubic feet. Also that the Bonnyrigg and Lasswade Gas Company are about to adopt the process, and propose to reduce the price of gas from 5s. to 4s. 7d. per 1000 cubic feet.

The working results of the following Companies in the past financial year may be briefly noticed: The Crieff Gas Company have paid a dividend at the rate of 5 per cent., and a bonus of the same amount, and have reduced the price of gas from 5s. to 4s. 2d. per 1000 cubic feet. The Jedburgh Gas Company earned a profit of £275, out of which they have paid a dividend at the rate of 6s. per £6 share, and carried forward £43. The Pittenweem Gas Company have paid a dividend at the rate of 10 per cent., and reduced the price of gas from 4s. 7d. to 4s. 2d. per 1000 cubic feet.

In last week's "Notes," it was stated that the dividend of the Dunfermline Gas Company was 10 per cent. last year. I am informed that this was not quite accurate, as the rate declared a year ago was 7 per cent.

It is a pity that, after all that has been done in connection with the proposed borrowing of £20,000 by the Paisley Gas Commissioners, the proceedings should come to nothing. The Secretary for Scotland, it will be remembered, notwithstanding the Sheriff reported unfavourably of the proposal, stated his willingness to grant a Provisional Order authorizing the borrowing of the money. It has been discovered, however, that the recently passed Burghs Police Act for Scotland, has superseded the Act of 1862, under which the application was made, and that therefore all that has taken place is null and void. A new application will require to be made, if the Commissioners are to proceed with their proposal. No meeting has as yet been held; but it is considered probable that no further steps in connection with the loan will be made for some time.

A report was presented to the Dundee Gas Commission on Wednesday, by Messrs. Urquhart and Small, the Engineers for the electric installation, in which it was stated that the installation was now practically completed, and that the total cost had been £19,607. The Engineers also said that there had been some trouble from accumulations of lighting gas in the pipes and junction boxes; and that, in order to provide for better ventilation of the pipes, they had designed a new method of connecting the cables, which would enable them to use gratings instead of close covers over the boxes.

Sulphate of ammonia again shows an advance—the prices quoted being £13 5s. per ton for immediate, and £12 5s. for winter delivery.

The accounts for the past year of the Glasgow Corporation Water Department, show an income of £171,867—an increase of nearly £2000 over the receipts for the previous year. The expenditure was £137,183; so that there is an ample surplus. In 1856-57, when the Corporation acquired the water-works, the income was only about £60,000; and the expenditure, £58,000. Then the domestic water-rate was 1s. per pound on the south of the Clyde, and 1s. 2d. on the north side; and it is now 6d. per pound. At that period the capital account was £750,000; whereas at the present time it is nearly £3,000,000. These figures illustrate as well as anything could do the great advance which has been made by the city.

The Dundee Water Commission yesterday agreed to the proposed domestic water-rate of 1s. 2d. per £1—an increase of 2d. on the rate for the past few years. Mr. Ballinghall, one of the members, said that Professor Frankland, in a report on the quality of the water, recommended that it should be filtered. It would be desirable if they could do this; but, in view of the increased rate, they could not face such an expenditure for some considerable time. In a report by Mr. Baxter, the Water Engineer, it is stated that the average daily consumption last year was 8,461,950 gallons, which was equal to 48 gallons per head of the population per day.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 8.

Sulphate of Ammonia.—There is practically no change in the position since last week; and although transactions have been limited, a little concession on the part of sellers would have materially increased the volume of business. By holding off as long as possible, some consumers seem to be under the impression that prices may shortly become somewhat easier; but, viewing the actual position, there is no reason why this expectation should be realized. The market closes firm at £13 2s. 6d., Hull and Liverpool; and £13 2s. 6d. to £13 5s., Leith. Almost the entire depletion of stocks of nitrate has prompted holders to advance the price to 10s. 3d.

LONDON, *July* 8.

Tar Products.—This market continues in a lifeless condition; both buyers and sellers being equally indifferent about business. Tar contracts continue to be let at prices ranging according to position and quality, from 9s. to 12s. per ton. Carbolic acid moves off slowly; but a determined effort is being made to depress the price. Creosote is in an abnormal condition; while the makers in certain localities have agreed not to sell under a given price in their districts. They are selling at a figure which would leave them barely ¾d. per gallon outside. The market quotations to-day are: Tar, 9s. to 12s., according to position. Pitch, 23s. 6d. Benzols, 90's, 1s. 6d.; 50's, 1s. 5d. Solvent naphtha, 1s. 0½d. Toluol, 1s. 5d. Crude benzol naphtha, 30 per cent., 7½d. Creosote, 1d. Creosote salts, 16s. Carbolic acid, 60's, 1s. 10d.; 70's, 2s. 2d.; crystals, 7d. Cresol, 1s. 8½d. Anthracene, nominal, 30 per cent. "A," 1s.; "B," 8d.

Sulphate of Ammonia.—The continuous improvement in the value of nitrate is distinctly impressing itself on the value of sulphate. Buyers are now quite willing to pay £13 to £13 5s. less 3½ per cent. for 24 per cent. Makers' stocks being entirely cleared out, and second-hand parcels having now been realized, the market value of sulphate is not unlikely to still further go up. Gas liquor is quoted at 8s. 6d. to 9s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is no specially new feature to notice since last week in connection with the coal trade of this district, except that the wages question is gradually progressing towards some development. Notices have been served to terminate contracts at a number of the collieries in the district; and the remainder will be served during the next few days. Pit meetings of the men have also been held at many of the collieries, to consider the matter and appoint delegates to attend a general district meeting, and afterwards a special conference to take place in Manchester. So far as there is any possibility of judging as to the probable outcome of the matter, it seems very likely that there will be a strike of the men before the question can be settled. The probability of a strike has not yet brought any largely increased weight of buying upon the market; and all descriptions of round coal continue a drug, with prices about the same as last quoted. There is perhaps less disposition to make specially low quotations to clear off surplus quantities; but apart from this there is no improvement. Best Wigan Arley coal can still be bought readily at 11s.; Pemberton four-feet and seconds Arley, at 8s. 6d. to 9s.; common house coals, at 7s. 3d. to 7s. 6d.; with steam and forge coals ranging from 6s. to 6s. 6d. per ton at the pit. With regard to the gas-coal trade, the position is practically unchanged; and where contracts have been settled, they are mostly on the basis of about 1s. 6d. under last season's prices. For engine classes of fuel, there has been some pressure of demand; but this is due more to the scarcity of slack which has prevailed for some time past, than to the threatened strike of miners. Prices remain firm at full rates; but there has been no real advance upon these. At the pit mouth, burgy ranges from 6s. 3d. to 6s. 6d.; best slack, 5s. 3d. to 5s. 6d., with some special sorts fetching 5s. 9d; medium, 4s. 6d. to 4s. 9d.; and common, 3s. 9d. to 4s. per ton.

Northern Coal Trade.—There is a distinctly better volume of trade showing itself just now. Many users of coal are dreading a serious strike, such as that of last year; and in consequence, they have sent in larger orders. The price of coal generally is therefore firmer, though there is an abundant supply obtained by the working of rather fuller time. Best Northumbrian steam coal is now quoted at 9s. 3d. to 9s. 6d. per ton f.o.b.; but the collieries cannot supply prompt quantities, and hence the price is to some extent nominal. With a full production of large coals, there is a corresponding increase in the output of small steam coals; and the price for this quality is about 3s. 3d. per ton. For gas coals, there is a larger demand; and, if there be any change in prices, it is in the direction of increased firmness. Generally the price is 6s. 3d. to 6s. 6d. per ton f.o.b., though one or two exceptionally situated collieries ask 7s. for their output. It seems to be dreaded that the entanglement of the Durham miners in the National Federation may lead to the extension of the wages dispute to this district, though the coalowners have as yet made no claim for further reductions of wages. Manufacturing coal is in better demand. Coke is firm, more being sent to the North-western furnaces; while the exports are fairly good. The price for best Durham kinds is steady at 14s. per ton f.o.b. Gas coke is being rather increased in the output; and some of the companies have considerable stocks. There is no alteration in price.

Scotch Coal Trade.—The situation in Scotland has not altered much during the week; but what change has occurred has been—probably owing to the threatened troubles in England—in the direction of firmness. The miners are by no means united as to the policy of restricting the working days to four per week. It is evident also that, taking the United Kingdom as a whole, they are far from being federated, because, at some of the men's meetings in Scotland, an advance of wages is being urged, while in England their brethren are having a reduction forced upon them. Of course, if the pitmen in England come out on strike, there will be busy times in Scotland; and an immediate advance in both prices and wages. The prices quoted this week are: Main, 6s.; ell, 7s. 3d. to 7s. 6d.; splint, 7s. to 7s. 3d.; and steam, 7s. 9d. to 8s., f.o.b. Glasgow—an advance of 3d. upon the three latter classes. The shipments also show an improvement; the total for the week having been 156,816 tons—an increase of 12,960 tons compared with the preceding week, and of 13,438 tons when compared with the corresponding week of last year. The increases were chiefly at the Clyde ports, Leith, and Burntisland. For the year to date, the total shipments have been 3,285,422 tons—a decrease on the same period of last year of 364,018 tons.

The Judgment in Perkins v. Wright and Co.—At the close of the report of the proceedings in the above-named case which appeared in the JOURNAL last week, it should have been stated that Mr. Justice Collins decided against the plaintiff, who therefore failed to substantiate his claim. The defendants accordingly had judgment in their favour on both the claim and the counterclaim.

Wolverhampton Corporation Water Department.—The annual report of the Water Committee of the Wolverhampton Corporation states that the profit for the year ended March 31 last, after paying interest charges on the capital, and providing for the sinking fund, amounts to £2862; and that the income from sales of water has been £1009 in excess of the previous year. It also mentions that the Bilston Commissioners have introduced into Parliament this session a Bill to enable them to obtain an independent supply of water. The measure has already passed the House of Lords, and is now proceeding through the House of Commons as an unopposed Bill. On its receiving the Royal Assent, the appeal by the Commissioners to the House of Lords against the decision of the Court of Appeal in favour of the Corporation, which now stands adjourned by consent, will ultimately be abandoned. The purchase-money (£9000) payable by the Commissioners to the Corporation under an agreement entered into in November, 1892, may, if the Bill becomes law, be applied by the Corporation to any purpose to which capital is applicable, and to which it may be expressly appropriated by resolution of the Council.

The Brymbo Water Company and an Alleged Illegal Diversion of Water.—At the Wrexham Police Court yesterday week, the Brymbo Water Company summoned the Minerva Lime Company, Limited, and several of their workmen, and three men in the employ of the Lester's Lime Company, for unlawfully and illegally diverting water from the Abergroes stream—atributary of the Nantyffrith river, both of which are in the watershed secured by the Company by Act of Parliament. Mr. W. Wynn Evans appeared for the plaintiffs, and stated that the defendants had from time to time taken away sods from a certain part of the Abergroes stream (which was a narrow one), and so diverted the water to their own works. When they found that the sods were removed, the Company's men replaced them; and there had been quite a small war between the workmen of the two parties. On June 17, the sods were again removed; and the water was running to the defendants' works. The reservoir keeper closed up the gap; and some of the defendants took the sods away, while others looked on to see that they were not interfered with. The other defendants—the men of Lester's Lime Company—diverted the water by constructing a small dam across the stream. The Water Company were obliged to take proceedings, not only for their own protection, but for the protection of the public, especially as the supply of water in the recent dry weather was materially diminished. Evidence having been given in support of the charge, Mr. Colt Williams, for the defence, submitted that this was a case in which their Worships had no jurisdiction, as it was clearly shown by the evidence that there was, and had been for years, an undoubted dispute as to title. The Magistrates were not satisfied that there had been an illegal diversion of the water; and, as there was a question of right involved, they thought the parties had better go to a higher Court.

The Birkenhead Corporation Gas Committee's Contracts.—At last Wednesday's meeting of the Birkenhead Town Council, Alderman Bloor, in moving the confirmation of the proceedings of the Gas and Water Committee, stated that they were favourably placed as regarded their contracts this year. On the item of coal alone, he expected a saving of about £3500; and, with regard to the tar they had for disposal, he thought they would have an increase of something like £1000. A loss, however, was anticipated on coke and the sale of ammoniacal liquor. Notwithstanding this there would be, he thought, a surplus; and it was possible that the gas consumers might have some concessions made to them, in a direction which he was not able to indicate, before the end of the year. A letter was then read from Messrs. G. Atkin and Co., complaining that they had not been fairly treated in the matter of their tender for surplus tar. The advertisement asking for the tenders stated that the contract was to be for one year; and they had tendered accordingly. The Gas and Water Committee, however, had accepted another tender for five years. Alderman Bloor explained the circumstances under which the tender had been accepted. He said that rightly or wrongly the Committee had a feeling that there had been a "ring" formed, against which they had striven in vain. Some four or five firms had been in the habit of tendering for this tar at different amounts, of which Messrs. Atkin's was generally the highest; and, when they obtained the contract, they made arrangements among themselves for the disposal of the tar. The highest tender this year, which was that of Messrs. Atkin, was 14s. 6d.; and the Committee, believing that this was not the value of the tar, decided not to accept it, and instructed the Engineer (Mr. T. O. Paterson) and himself to make the best arrangements they could for the disposal of the tar. This was done; and an offer of 18s. per ton for five years was received from Mr. J. Hardman, of Milton, Staffs. Mr. Atkin was communicated with; but he could not see his way to increase his offer more than by 6d. a ton until after Mr. Hardman's tender was accepted, when he sent in an offer of 19s. The difference between Messrs. Atkin's first tender and Mr. Hardman's tender was about £3000 during the ensuing five years; and he thought the Gas Engineer was entitled to the thanks of the community for having brought this transaction to such a successful issue. The proceedings of the Committee were confirmed.

The Aberdeen Corporation and Electric Lighting.—Sir G. Trevelyan, Secretary of State for Scotland, has sanctioned the borrowing, by the Aberdeen Town Council, of £20,000, for the construction of the Corporation electric lighting installation.

Electric Lighting for Tunbridge Wells.—At the last meeting of the Tunbridge Wells Town Council, Alderman Clifford, on behalf of the Electric Light Committee, again brought forward the proposal to put down an installation of the electric light, at an outlay of £13,000. The proposition was adopted by 16 votes to 9.

The Birmingham Corporation Water Scheme.—Some of the members of the Birmingham Corporation Water Committee have recently visited Radnorshire, accompanied by their Consulting Engineer (Mr. James Mansergh), to inspect the new watershed and the sites of the reservoirs. While there, they discussed the questions of laying a railway from Rhayader to the watershed (a distance of six miles) and the housing of the workmen. Tenders have been invited for the railway; and, as early as practicable, the work will be started.

The New Water-Works at Gothenburg.—The new pumping-station for the Gothenburg Water-Works is located at Alelzeken, some three miles from the town. The pump-house forms a large hall, containing two high-pressure pumps, worked by two steam-engines indicating 100-horse power each. With a speed of 60 strokes a minute, they yield 56 litres, or about 12¼ gallons, of water per second. There is room for a further installation of two similar pumps with engines, for which the foundation is ready. The water is taken from the river through a canal, some 160 feet long, built of concrete, and conveyed into large covered filters, each with a sand area of 100 feet by 135 feet.

The Electric Lighting Scheme for Cardiff.—A little additional information relative to this scheme was published last week in connection with the ceremony of laying the "memorial" stone of the central station by the Mayor of Cardiff. The buildings which are to be immediately erected will occupy a space about 80 feet square; but provision has been made, both as to the site and the character of the buildings, for extensions being carried out from time to time. The total cost of the present portion of the scheme is £32,500, which includes the outlay for a chimney 150 feet high—a structure which is expected to meet present and future requirements. The first thing which it is proposed to do is to light the streets in the compulsory area by means of 44 arc lamps, each of 2000-candle power. This it is hoped will be brought about within the next three months; and by Christmas the Corporation believe they will be able to supply every possible consumer within the district. The arc lights will be 22 feet above the street-level; and in nearly all cases they will be placed in the centre of the road.

Extended Application of the New Conveyor Company's Plant.—The New Conveyor Company, Limited, are supplying a lime elevator to the order of Mr. Fletcher W. Stevenson, Engineer of the Sheffield Gas Company, and a coke elevator, to fill the waggons automatically, for Mr. James Eldridge, of Oxford. An installation of conveyors and elevators, with Little's patent compressed chain, recently put in operation at The Gaslight and Coke Company's tar and liquor works at Beckton, is said to be a great improvement on the chains hitherto used. The Vice-Chairman of the Gas Committee of the Huddersfield Corporation (Mr. Mellor), and the Gas Engineer (Mr. W. R. Herring), recently visited the New Conveyor Company's works, and inspected the plant—comprising engines, breakers, conveyors, and elevators—for the new retort-house at Huddersfield. The new compressed steel chain was shown at work. All the buckets for the coke elevators are of stamped seamless steel, with renewable mouthpieces to take up the wear. The visitors expressed themselves highly pleased with the manner in which the order had been carried out.

Alleged Waste of Water.—At the Epsom Petty Sessions, Mr. F. E. Boughton was lately summoned, under section 60 of the Water-Works Clauses Act, 1847, for wilfully wasting the water of the Epsom Local Board of Health. Mr. G. H. White, on behalf of the Board, said the charge against the defendant was that he allowed water to run through a hose on to his lawn without leaving anybody to look after it. This he contended was waste of water, which was now very scarce. George Saunders, Assistant Engineer at the Water-Works, deposed to seeing the water running from the hose both on the 18th and 19th of June. There was no one in attendance. In answer to questions from the Bench, Mr. White said the defendant had an outside tap, for which he paid 15s. a year extra. The tap was for obtaining water for watering the garden. The Board considered the use of the hose a legitimate thing in ordinary seasons; but this year, water being so valuable, they had taken action. The case was dismissed, with £3 3s. costs, in addition to Court costs. The Chairman (Mr. W. E. Chambers) recommended the Board to issue notices warning persons against waste.

Chicago Water Supply.—The British Consul at Chicago, in his last report referring to the subject of the water supply of the city, says there is little doubt that it is far from what it ought to be, considering the vast expanse of perfectly pure water from Lake Michigan so close at hand. The difficulty is that the Chicago River is an open sewer flowing sluggishly sometimes up stream and sometimes down, according as the pumping power exceeds the natural flow; and in the spring particularly, when heavy rains are most frequent, the present power is inadequate to cope with the flush, and to pump the river water into the canal, whence it should find its way down the Illinois River to the Mississippi, and consequently the flow is into the lake. At that season it is especially necessary to boil and filter the water for drinking purposes, as pollution reaches some distance into the lake. An important work has, he says, been completed in the new tunnel and crib at four miles' distance from the shore, which was opened at the close of the past year. Still, some of the supply of water to the city is derived from the old two-mile crib; and it is prudent at all times to boil and filter the water before drinking. The tunnel on the south side which is to supply Jackson Park was not finished at the beginning of June. But the Exhibition authorities have prohibited the supply inside the grounds of drinking water which is not filtered; and a large number of fountains of filtered water are provided for the public. The quantity of water supplied to the city last year was 71,035 million gallons.

A Lock-Out in the Coal Trade.—By way of supplement to the remarks made in other parts of the JOURNAL on the condition of the coal trade, it may be stated that a ballot taken last Saturday showed that an overwhelming majority—3430 against 78—of the Dean Forest miners are unfavourable to the proposed 25 per cent. reduction in wages. The men brought out their tools from several pits at night, and about 3000 of them are now looked out.

Electric Lighting Fatality.—On the Piazza Quirinal in Rome last Friday night, two electric light lampmen lost their lives through a piece of almost incredible carelessness. One of the large lamps opposite the palace suddenly went out. The lampman belonging to the district brought a ladder and ascended; but he had scarcely touched the carbon when he fell to the ground from a height of 16 feet. His companion, believing him to be seized with sudden illness, went up in his place, but almost immediately fell. The men were conveyed to the hospital, but they were both dead. Both men had, it appears, neglected to shut off the current, which they could easily have done by making use of the switch provided for the purpose in the base of the lamp-post.

Gas-Works Labourers' Wages at Halifax.—At the meeting of the Halifax County Borough Council last Wednesday, a minute was presented to the effect that the Gas Committee had decided to raise the wages of the outdoor labourers in connection with the gas-works from 5½d. to 5¾d. per hour. In order to enable him to make some remarks as to the way in which the request for an advance had been made to the Committee, Mr. Wainhouse moved an amendment that the minute be referred back. He explained that he was not at all opposed to the advance, but the manner in which it had been asked for was not regular. Alderman Patchett seconded the amendment. This ultimately led to a discussion of a very disorderly kind—a score or so of members talking at once, and so loudly that for a time the Chairman could not be heard. When, afterwards, Mr. Wainhouse desired to withdraw the amendment, objections were raised in several quarters, and not only was a vote taken, but the names. It was, of course, lost, and the minute was adopted.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 79.)

Issue.	Share	When ex-Dividend	Interest & Div. Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apl.	10½	Alliance & Dublin 10 p. c.	10	15½—17½	..	6 0 0
100,000	10	,,	7½	Do. 7 p. c.	10	11½—12½	..	6 0 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	102–104	..	4 16 2
100,000	20	31 May	8	Bahia, Limited	20	10½—11½	..	13 18 3
200,000	5	12 May	6½	Bombay, Limited	5	5½—6	..	5 8 4
40,000	5	,,	6½	Do. New	4	3⅜—4¼	..	6 2 6
380,000	Stck.	24 Feb.	11½	Brentford Consolidated	100	222—227	..	5 1 4
180,000	,,	,,	8½	Do. New	100	168—173	..	4 18 3
220,000	20	15 Mar.	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	104—107	..	4 13 5
320,000	20	13 Apl.	11½	British	20	42—44	..	5 4 7
50,000	10	15 Mar.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	15—16	..	5 6 3
328,750	10	—	—	Buenos Ayres (New) Limited	10	6¼—6¾	..	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	97–100	..	6 0 0
150,000	20	24 Feb	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	28 Apl.	12½	Commercial, Old Stock	100	245—250	..	5 0 0
165,000	,,	,,	9½	Do. New do.	100	182—187	..	5 1 7
160,762	,,	15 June	4½	Do. 4½ p. c. Deb. do.	100	125—130	..	3 9 3
800,000	Stck.	15 June	13	Continental Union, Limited	100	227—232	..	5 12 0
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	190—195	..	5 2 7
75,000	Stck.	15 Mar.	10	Crystal Palace District	100	190—195	..	5 2 7
486,090	10	27 Jan.	10	European, Limited	10	21½—22½	..	4 8 11
354,060	10	,,	10	Do. Partly paid	7½	15—16	..	4 13 9
3,596,560	Stck.	10 Feb.	12	Gaslight & Coke, A, Ordinary	100	224—229	..	5 4 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	95—99	..	4 0 10
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	263—268	..	3 14 7
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	120—125	..	4 0 0
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	175—180	+5	4 3 4
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	170—175	..	4 0 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	262—267	..	3 14 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	156—160	..	3 15 0
1,061,150	,,	15 June	4	Do. 4 p. c. Deb. Stk.	100	125—128	..	3 2 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	128—132	..	3 8 2
908,000	,,	,,	6	Do. 6 p. c. do	100	167—172	..	3 9 9
3,800,000	Stck.	12 May	12	Imperial Continental	100	222—227	−2	5 5 8
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	5—5½	..	5 9 1
560,000	100	4 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	100	103—105	..	4 15 3
541,920	20	15 June	5	Monte Video, Limited	20	13—14	..	7 2 10
150,000	5	31 May	10	Oriental, Limited	5	7½—8	..	6 5 0
60,000	5	29 Mar.	7	Ottoman, Limited	5	4¼—4¾	..	7 3 8
166,870	10	—	2	Pará Limited	10	2—2½	..	—
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	100—105	..	5 14 3
500,000	100	1 June	6	2nd Do.	100	98—102	..	5 17 8
150,000	10	28 Apl.	5	San Paulo, Limited	10	8½—9½	..	5 5 3
500,000	Stck.	24 Feb.	15½	South Metropolitan, A Stock	100	297—302	..	5 2 8
1,350,000	,,	,,	12	Do. B do.	100	244—248	..	4 16 9
230,000	,,	,,	13	Do. C do.	100	250—255	..	5 1 11
750,000	,,	13 Jan.	5	Do. 5 p. c. Deb. Stk.	100	148—152	..	3 5 9
60,000	Stck.	15 Mar.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
744,897	Stck.	29 June	10	Chelsea, Ordinary	100	257–262*	..	3 16 3
1,720,252	Stck.	29 Mar.	8	East London, Ordinary	100	204—209	..	3 16 7
544,440	,,	29 June	4½	Do. 4½ p. c. Deb. Stk.	100	140–143*	..	3 2 11
700,000	50	15 June	8½	Grand Junction	50	107—110	..	3 17 2
708,000	Stck.	10 Feb.	11	Kent	100	280—285	..	3 17 2
1,043,800	100	29 June	9½	Lambeth, 10 p. c. max.	100	232–237*	..	4 0 2
406,200	100	,,	7½	Do. 7½ p. c. max.	100	195–200*	..	3 15 0
310,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	129—132	..	3 0 7
500,000	100	10 Feb.	12½	New River, New Shares	100	329—334	..	3 12 8
1,030,000	Stck.	27 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—137	..	2 18 5
902,300	Stck.	15 June	6	S'thwk & V'xhall, 10 p. c. max.	100	147—152	..	3 18 10
126,500	100	,,	6	Do. D 7½ p. c. do.	100	140—145	..	4 2 9
1,155,066	Stck.	15 June	10	West Middlesex	100	253—258	..	3 17 6

*Ex Div

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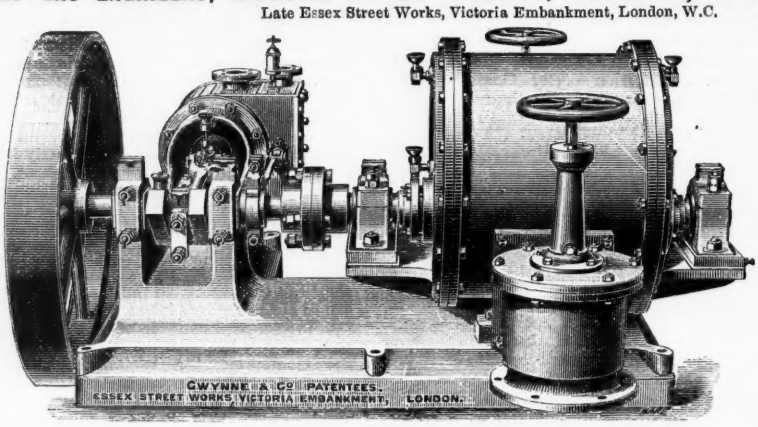

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SPECIAL BARGAIN.

FOR SALE—Two perfectly new Cast- Iron SCRUBBERS, 10 feet diameter by 50 feet high, with Wrought-Iron Domes, Cast-Iron Spiral Staircase, &c., complete. All plates machine planed. One or both Scrubbers will be sold to suit purchasers.
A perfectly new 30,000 per hour HORIZONTAL DOUBLE PUMP RECIPROCATING EXHAUSTER, with Steam-Engine, with Connections and Valves.
One Second-hand (thoroughly overhauled) VERTICAL PUMP EXHAUSTER, with Steam-Engine (with clean Water and Liquor Pumps attached), to pass 7000 cubic feet of Gas per hour.
One Second-hand (thoroughly overhauled) ROTARY EXHAUSTER, to pass 7000 cubic feet per hour (without Engine), fitted with Pulleys.
The whole of the above Plant can be inspected, and full particulars with prices will be sent, on application to No. 2241, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO BE SOLD, cheap—A Counter-balanced GASHOLDER, 34 feet diameter by 11 feet deep, in a Cast-Iron Tank, lying now at the Leominster Gas-Works. All in good condition.

Please communicate with No. 2250, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

RUSHDEN AND HIGHAM FERRERS DISTRICT GAS COMPANY, LIMITED.

REMAINDER OF PLANT FOR SALE.

SITE MUST BE CLEARED. NO REASONABLE OFFER REFUSED.

ONE Two-Lift Gasholder, new in 1888.

Makers, R. and J. Dempster. Outer lift, 35 ft. by 15 ft.; inner do., 33 ft. 6 in. by 15 ft.

One Single GASHOLDER, 30 ft. by 12 ft., thoroughly overhauled in 1887 by Messrs. R. and J. Dempster (New Columns, and Guide-Framing).

The above are in excellent condition and well worth the attention of any persons requiring Gasholders of the above capacity.

For particulars and permission to view, apply to JNO. T. LEWIS, Gas-Works, WELLINGBOROUGH.

TENDERS for the Lighting by Gas or ELECTRICITY of the CITY OF BELEM, the Capital of Gram Pará, Brazil, BY CONTRACT.

The Conditions of Contract and all Particulars may be had on application to the BRAZILIAN CONSULATE, at 6, Great Winchester Street, LONDON, E.C., or at the CONSULATES of LIVERPOOL and GLASGOW.

OSWALDTWISTLE LOCAL BOARD.

THE Gas Committee invite Tenders for the TAR and LIQUOR produced at their Works for One Year from the 31st day of July, 1893.

The quantity of Coal carbonized is over 3500 tons.

Further Particulars may be obtained from the Manager, Gas-Works, Church, near Accrington.

Endorsed tenders to be addressed to me and to be delivered not later than Wednesday, the 19th of July.

WM. SANDEMAN.
Clerk.

Local Board Offices, Oswaldtwistle,
June 13, 1893.

BOROUGH OF CHORLEY.

CORPORATION GAS-WORKS.

THE Chorley Corporation invite Tenders for the purchase of the surplus TAR produced at their Gas-Works for Twelve Months commencing the 1st of August next, delivered in the Contractor's Tanks at the Chorley Railway Station.

Any further Information may be obtained from Mr. R. Fearnley, Gas Manager, Chorley.

The Corporation do not bind themselves to accept the highest or any tender.

Tenders, endorsed "Tar," to be sent to me on or before Tuesday, the 18th of July inst.

By order,
JNO. MILLS,
Town Clerk.

Town Hall, Chorley,
July 6, 1893.

BOROUGH OF CHORLEY.

CORPORATION GAS-WORKS.

THE Chorley Corporation are prepared to receive TENDERS for Twelve Months' supply of the following for their Gas-Works:—

(1) GAS COAL 7000 tons.
(2) CANNEL 500 tons.
(3) LIME.
(4) VITRIOL 80 to 100 tons.

The supply to commence on the 1st day of September next.

Forms of Tender for Coal and Cannel, and any further Information, may be obtained on application to Mr. Fearnley, Gas Manager.

Tenders, duly endorsed, to be sent to me on or before Tuesday, the 18th of July inst.

The Corporation do not bind themselves to accept any tender.

By order,
JNO. MILLS,
Town Clerk.

Town Hall, Chorley,
July 6, 1893.

WALLASEY GAS-WORKS.

TO TAR DISTILLERS AND OTHERS.

THE Wallasey Local Board are prepared to receive TENDERS for the purchase of the AMMONIACAL LIQUOR (about 2000 tons per annum), and also of the surplus GAS TAR (about 1200 tons per annum), produced from time to time at their Gas-Works, Great Float, near Birkenhead, during a period of One, Two, or Three Years, from the 30th of September next.

A pipe is laid between the Gas-Works and the Great Float for the conveyance of the Tar and Liquor into the Contractor's Boats; and the Board will, if necessary, provide appliances on their own Siding to pump the products direct into the Contractors' Railway Tank-Waggons.

Any further Information may be obtained on application to Mr. H. Ashton Hill, Gas and Water Manager to the Board.

Sealed tenders, endorsed "Tar, &c.," and addressed to the Chairman of the Gas and Water Committee, to be left at my Office, as below, not later than Five o'clock in the afternoon of Monday, the 24th inst.

The Board do not bind themselves to accept the highest or any tender.

By order,
W. DANGER,
Clerk to the Board.

Public Offices, Egremont, Cheshire,
July 7, 1893.

MORECAMBE GAS AND LIGHT COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 3500 tons of GAS COAL, to be delivered on the Gas-Works Siding, Midland Railway, Morecambe, in such quantities as may be required during the Year.

Tenders, specifying the description of the Coal, the name of the pit at which it is raised, and the terms for net monthly payment, are to be sent on or before Monday, the 24th of July, 1893, endorsed "Tender for Coal."

WILLIAM DUFF,
Secretary and Manager.

Market Street, Morecambe,
July 7, 1893.

EDINBURGH AND LEITH CORPORATIONS GAS.

THE Commissioners invite Tenders to supply COAL at their Works in Edinburgh and Leith, from the 1st of September to the 15th of May next.

Tender Forms and all Information can be had on application to the Engineer at either of these Works.

Offers must be lodged not later than Ten o'clock on Monday Forenoon, the 17th current, in Sealed Envelopes, addressed to the undersigned.

The Commissioners are not to be bound to accept the lowest or any tender.

JAMES M'G. JACK,
Clerk.

25, Waterloo Place, Edinburgh,
July 3, 1893.

MILLOM LOCAL BOARD.

TENDERS are invited for the supply of 1500 tons of GAS COAL at such times and in such quantities as the Board require during Twelve Months from the 1st of August next.

The Coal must be of the best quality, and as free as possible from Bats, Pyrites, and Dross.

Full Particulars of the Coal and Colliery, and an epitome of the Working Analysis to be given.

The price per ton, delivered free at Millom Station, and (where applicable) at the nearest and most available Port to the Colliery or Depôt, to be stated.

Sealed tenders (on forms which can be had on application to the undersigned), endorsed "Tender for Coal," to be sent in to me not later than the 11th of July next.

The Board will not be bound to accept the lowest or any tender.

W. T. LAWRENCE,
Clerk to the Board.

Local Board Offices, Millom,
July 3, 1893.

COMMERCIAL GAS COMPANY.

THE Directors of the Commercial Gas Company are prepared to receive TENDERS for the surplus BREEZE produced at their several Works for the Twelve Months ending the 31st of July, 1894.

The quantities are estimated to be as under, but the same cannot be guaranteed, and may be more or less—

At the Stepney Works in the Regent's Canal, 2500 chaldrons of 48 bushels.
At the Wapping Works, in the Thames, 1200 chaldrons.
At the Poplar Works, in Bow Creek (free water-way), 5000 chaldrons.

The tenders may be for the whole or for one or more Works separately.

The Contractors must give security to remove the Breeze as it accumulates, to pay for the same monthly, and generally for the due fulfilment of the contract.

The Form of Agreement to be signed can be seen at the Company's Offices.

Tenders, sealed, and endorsed "Tender for Breeze," to be delivered here not later than the 22nd of July inst.

The Directors reserve to themselves the right to accept any tender in part or in whole, and do not bind themselves to accept the highest or any tender.

Commercial Gas-Works, Stepney, E.,
July 10, 1893.

HARTLEPOOL GAS AND WATER COMPANY.

IMPORTANT SALE OF SHARES.

TO be Sold by Auction, at the "Royal" Hotel, West Hartlepool, on Thursday, the 27th day of July, 1893, at three o'clock in the afternoon precisely—JOHN W. CROSBY, Auctioneer—300 SHARES of £10 each (Maximum Dividend limited to 7 per cent. per annum), being part of the Gas Capital authorized to be issued by the Hartlepool Gas and Water Act, 1878, and required by Section 9 of that Act to be offered to the public for sale by Auction.

The above Shares will be entitled to Dividend from the 28th day of August next, and to be registered in the name of the purchaser without charge.

A Deposit of 10 per cent. will be required to be paid at the time of sale; the remainder to be paid on or before the said 28th day of August.

The Shares will be sold in lots of ten each.

By order of the Directors,
THOMAS TREWHITT,
Secretary.

Hartlepool Gas and Water Company's Office,
West Hartlepool, June 8, 1893.

MEIKLEJOHN'S PATENT

Improved Slide-Valve Anti-Dip.

Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.

Is cheap and easily fixed to any form of main.

Will be found the most efficient appliance of the kind yet introduced.

Further particulars and price from

C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
(Late N. MEIKLEJOHN, Longwood.)

Fcap. 4to, Cloth, price 7s. 6d., post free.

Practical Photometry.

By William Joseph Dibdin, F.I.C., F.C.S.,

London: WALTER KING, 11, Bolt Court, FLEET ST., E.C.

Price 6s., Cloth Bound, Bevelled Boards.

THE

GUIDE-FRAMING OF GASHOLDERS

AND OTHER PAPERS

CHIEFLY RELATING TO

STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS.

BY

F. SOUTHWELL CRIPPS, Assoc. M. Inst.C.E.

Reprinted from the JOURNAL OF GAS LIGHTING. *Fully Revised and Corrected by the Author, with many Additions.*

LONDON:

WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road,

CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works

(also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

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AUG. KLÖNNE,

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REGENERATIVE FURNACES.

Unsurpassed in

Efficiency, Economy, Durability, and Easy Working.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.

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Established 1872.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained.

NIDDRIE CANNEL

A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO

The Niddrie & Benhar Coal Co., Ltd.,

15, HANOVER STREET,

EDINBURGH.

Telegrams: "BENHAR, Edinburgh."

JAMES WHITE & CO., LTD.,

WIDNES, LANCASHIRE,

Manufacturers of Special

FIRE-BRICKS, FIRE-CLAY, & FURNACE CEMENT.

FOR GAS FURNACES our GANNISTER and SILICA FIRE-BRICKS are acknowledged to be the best and most durable in the Market.

GANNISTER and SILICA FIRE-CLAY guaranteed of the Purest Quality.

FURNACE CEMENT specially made for repairing Furnaces and stopping Cracks.

ANALYSIS AND REFERENCES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.

Tudhoe Gas Works,
Spennymoor,
8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.

Yield of Coke: 13¼ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100 00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

G. WALLER & Co.'s NEW PATENT GAS EXHAUSTER

MADE WITH FOUR BLADES,

To pass 300,000 Cubic Feet per Hour, with or without Engine combined.

IN USE AND ON ORDER FOR OVER 100 WORKS,

AND EQUAL TO

5,340,000 CUBIC FEET PER HOUR.

SPECIAL ADVANTAGES:—

The Four-Blade Exhauster **PASSES 50 PER CENT. MORE PER REVOLUTION** than any One or Two Blade Exhauster.

It takes 27 per cent. less power than any Two-Blade Exhauster.

It gives a steadier Gauge than any other Exhauster.

One of our 150,000 feet per hour Patent Four-Blade Exhausters passes continuously **180,000** cubic feet per hour, driven by a **12-INCH STEAM CYLINDER.** No other Maker can give a similar result.

Model of Patent Exhauster sent for inspection.

Oldest Makers of Beale Exhausters for over 300 Works.

Patent Compensating Steam Governor, Special Tar and Liquor Pumps, Gas-Valves.

Washer-Scrubbers, with **WOOD CLUSTERS,** and Tar Extractor combined.

PHŒNIX ENGINEERING WORKS,

PARK STREET, SOUTHWARK, LONDON, S.E.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,
FITTER.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production over 3200 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of over

400,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

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97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury LONDON, N.

Prices are Reduced.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

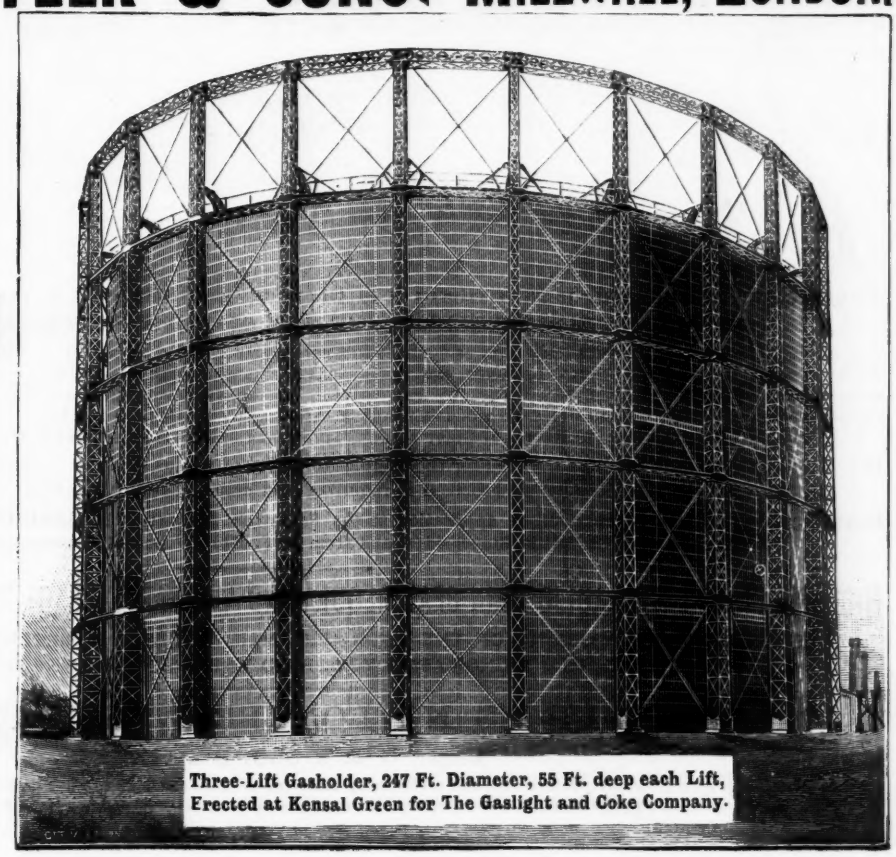
SAML. CUTLER & SONS, MILLWALL, LONDON.

NEARLY

8 MILLION

CUBIC FEET

CAPACITY.



Three-Lift Gasholder, 247 Ft. Diameter, 55 Ft. deep each Lift, Erected at Kensal Green for The Gaslight and Coke Company.

FAMOUS LEESWOOD

"CURLEY CANNEL."

YIELD: 15,306 CUB. FT. PER TON OF 30·62-CANDLE POWER.

SMOOTH CANNEL.

YIELD: 12,321 CUB. FT. PER TON OF 21·321-CANDLE POWER.

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CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

GAS COAL.

BEST

REAL OLD SILKSTONE GAS COAL,

Address THE STRAFFORD COLLIERIES COMPANY,

Near BARNSLEY, SOUTH YORKSHIRE.

INCLINED RETORTS,

FIRE BRICKS,

LUMPS, TILES,

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Special Bricks for Intense Heats.

GAS RETORTS.

CASTINGS AND EVERY REQUISITE FOR GAS-WORKS.

MOBBERLEY & PERRY,

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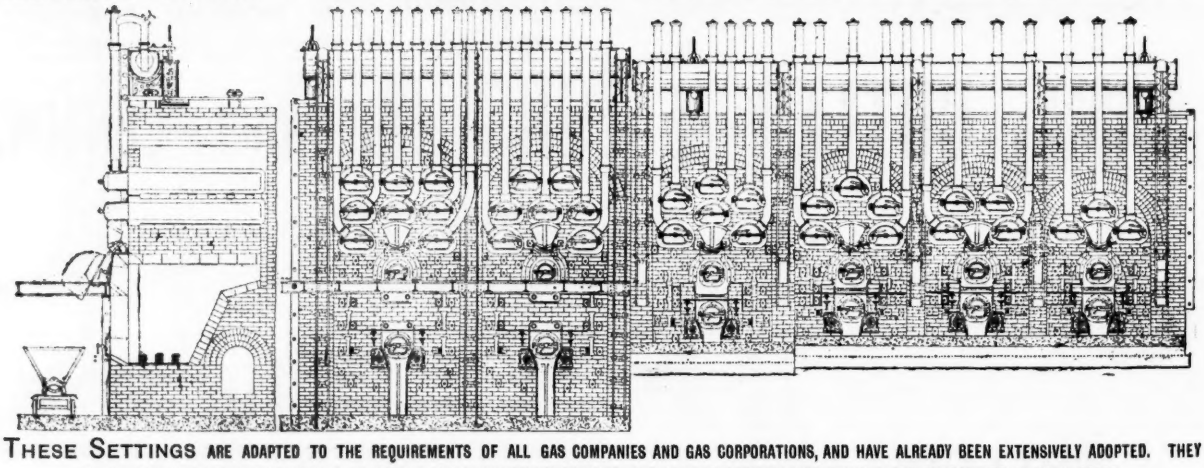
☞ Retort Setters sent to any part of the Kingdom.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S PATENTS.

All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

Now Ready, Price One Guinea.

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1879-1890.

By E. H. STEVENSON and E. K. BURSTAL, MM.Inst.C.E.

The Work published in 1879 by the late Mr. Stevenson is still on sale.

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MANUFACTURERS OF GASELIERS IN GLASS AND METAL.

OPENING ANNOUNCEMENT.

JAMES MILNE & SON, LTD.,

MILTON HOUSE WORKS, EDINBURGH,

Have pleasure in intimating the opening of a Branch Establishment at

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Consisting of SHOW-ROOMS, WAREHOUSE, and METER WORKSHOP.

Special attention given to Meter Repairs.

GAS FIXTURES, GAS AND WATER FITTINGS, SANITARY SPECIALTIES, &c.

HANNA, DONALD, & WILSON,

(Established 1851),

GAS ENGINEERS & CONTRACTORS,

Abercorn Foundry and Abbey Works,

PAISLEY, N.B.,

MAKERS OF

Gasholders and Gas Plant

OF EVERY DESCRIPTION.

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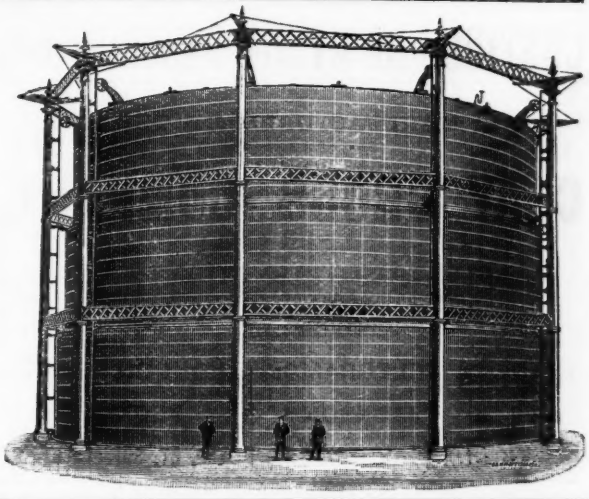

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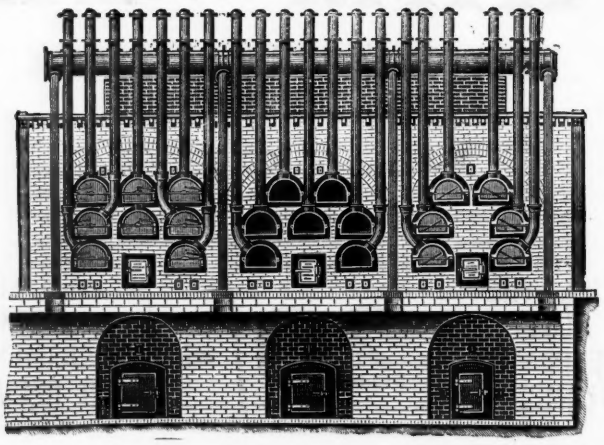

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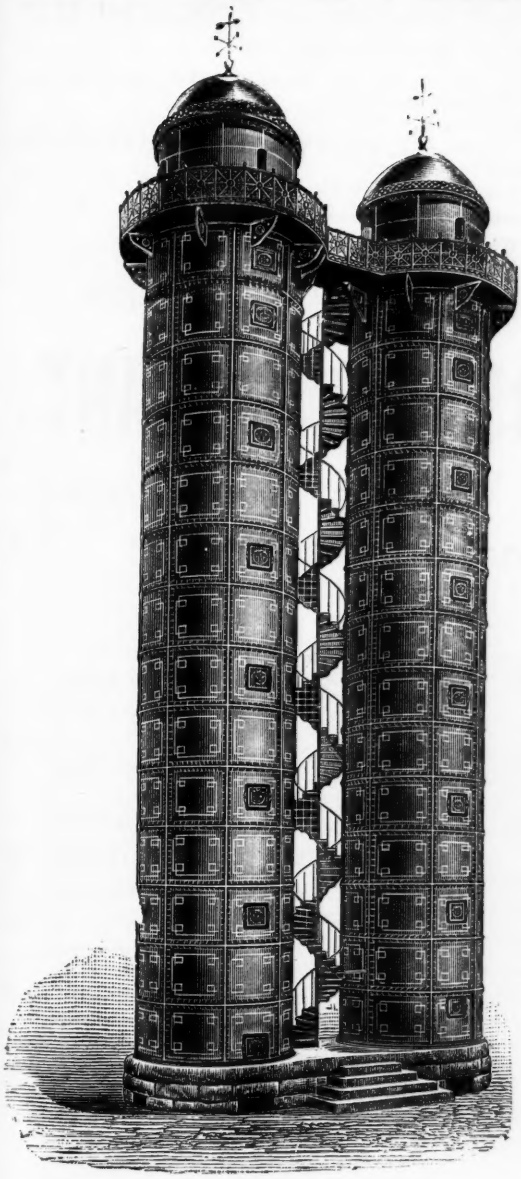

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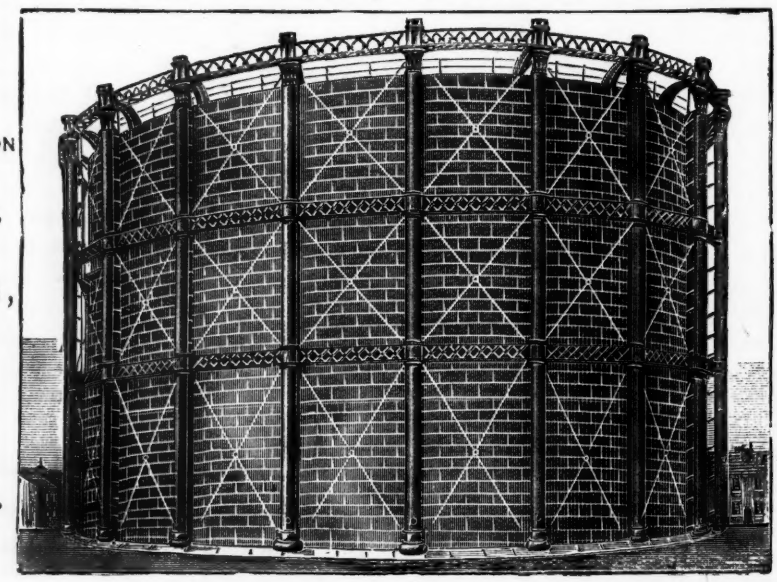

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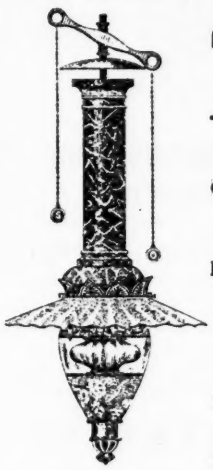

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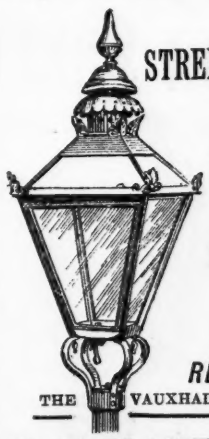

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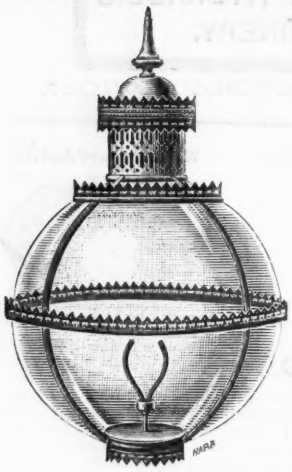

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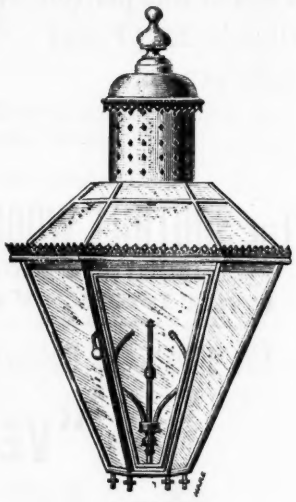

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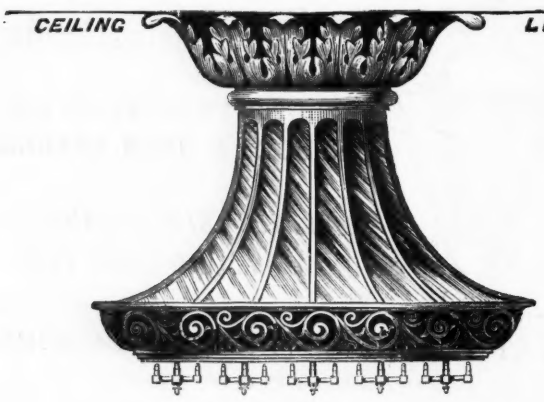

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[See also Advt., p. 66.

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